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VOL. II.—7TH YEAR—No. 13. SYDNEY: SATURDAY, SEPTEMBER 25, 1920. PRICE 6D.

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THE MEDICAL JOURNAL OF AUSTRALIA.

VOL. II.—7TH YEAR. SYDNEY: SATURDAY, SEPTEMBER 25, 1920. No. 13.

Presidential Address.

SECTION OF PATHOLOGY AND BACTERIOLOGY, AUSTRALASIAN MEDICAL CONGRESS, BRISBANE, 1920.

By W. J. Penfold, M.B., B.Hy.,
Director of the Commonwealth Serum Laboratories, Royal Park, Victoria.

RED CELL REFUSION IN THE PRODUCTION OF THERAPEUTIC SERA.

I am exceedingly grateful to the officers in charge of the Congress arrangements for their gracious invitation to me to preside over the meetings of this Section.

I regret that my experience of the subjects is largely confined to the bacteriological side, but I trust that I shall have a sufficiently keen appreciation of the new work which will be laid before us, to meet the requirements of the occasion to your satisfaction.

I am not foolish enough to believe that I have been selected for this position by reason of any merit of mine; I look upon the selection rather as an indication of the sympathy with which the foundation and development of a serum institute for Australia has been and is received.

I have chosen for the subject of my address "Red Cell Refusion in the Production of Therapeutic Sera."

It has been demonstrated by Abel, Turner, Marshall and Lamson that a dog bled to almost fatal exsanguination can be restored to good health by the re-injection of the red cells suspended in Locke's solution, the volume re-injected equalling the original bulk of the blood withdrawn. They, moreover, found that this could be done repeatedly without injury to the dog. They made no attempt to use this in the production of therapeutic or other sera and doubtless a large part of the improvement in the dog's health depended upon the Locke's fluid which was simultaneously introduced with the red cells. It is well known that the making up of the blood volume with any fluid is helpful in severe hæmorrhage and has been the current practice of surgeons for years.

It has been shown by Bayliss and other workers, working on shock, that large amounts of blood may be removed from animals and the blood pressure very efficiently restored by means of gum solution, without red cells.

The work given in this paper depends upon the returning of the red cell fraction of the blood alone, in the residual plasma, so that the operation is different from Abel's operation, no attempt being made to restore the blood volume.

In the past, in the making of serum, the following methods have been employed:—

The blood has been received into—

(1) A jar in which it is allowed to clot. The serum is collected after its expression from the clot. In this method the red cells of the blood are permanently entangled in the clot.

(2) Bottles or flasks containing oxalate solution to prevent clotting. In these containers the cellular elements of the blood are allowed to sediment and the supernatant plasma is removed in a sterile manner into other containers by means of a tube. The oxalated plasma so removed is then clotted by the addition of a lime salt and the expressed fluid from this clot constitutes the serum.

(3) Flasks containing a solution of sodium citrate or some other anti-clotting agent.

(4) Containers coated with paraffin or some other substance which prevents clotting.

Methods (2), (3) and (4) have this in common, that they permit the separation of the red cells from the plasma. In the first method, on the other hand, the red cells are permanently entangled in the clot. The method which I am about to describe to you cannot be used with the first of the old methods.

All the methods that have been used up to the present have the following grave disadvantage, *viz.*, they all produce profound anæmia, so that after a first bleeding of eight to ten litres in the case of a horse, for example, a week's interval should be allowed before a second bleeding is undertaken. This week's interval is by no means sufficient to allow of recovery from the anæmia. A horse may be bled in this way each week, but if the amount of blood abstracted be of the magnitude indicated above, the animal becomes more and more anæmic, so that after two, three or four bleedings it is necessary to give it a prolonged rest. This rest suitably consists of one week for every individual bleeding; that is to say, if the horse has been bled every week for four weeks, it should be given one month's rest. This method will be referred to throughout this communication as "the old method."

In some laboratories horses are immunized and bled every week, six to seven litres of blood being taken at each bleeding. Horses so treated, however, soon get out of condition and do not live long. In other laboratories large single bleedings of even twelve litres may be taken.

Under the new method that we are using, the animal is bled at two or three day intervals to the extent of 10 to 12 litres at each bleeding and the red cells are returned to the animal about two to three hours after each bleeding.

This bleeding is continued in the case of horses immunized against diphtheria toxin every second day (third day, if a Sunday intervenes) until the antitoxic content of the serum falls to 300 units per c.cm..

This system of repeated bleeding of animals which have been re-fused with their own red cells, I shall refer to throughout this paper as "the new method."

The scheme that has been inaugurated at the Commonwealth Serum Laboratories, is directed towards the prevention of the anæmia and allows of the more frequent bleeding of the horses. It consists in returning the red cells of the blood to the vessels of the animal from which the blood has been taken, so that the anæmia is removed forthwith, or alternatively the

red cells of another animal may be injected instead of the red cells of the animal which has been bled. The former method is much the better.

In carrying out this scheme the procedure is as follows:—

Ten to twelve litres of blood are removed from the horse into large bottles thoroughly cleansed and sterilized. To prevent clotting oxalate solution (potassium oxalate preferably) is thoroughly mixed with the blood by agitation as the blood is running from the vein into the receiver. The bottles are then permitted to stand to allow of the sedimentation of the red cells. This separation may be accelerated by the use of a centrifuge, but in the case of horse blood the centrifuge is not necessary. After the red cells have sedimented, the supernatant plasma is removed into one or more suitable containers and the remaining red cell fractions are collected into other containers, known as returning bottles. These red cells, by suitable means, are re-injected into the vein of the horse.

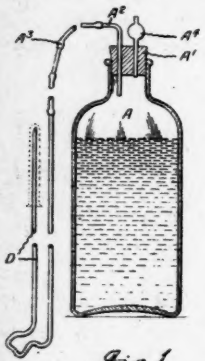

Fig. 1.

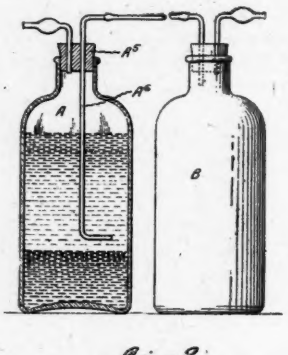

Fig. 2.

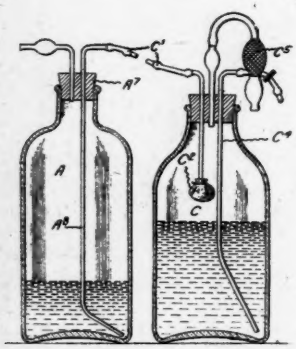

Fig. 3.

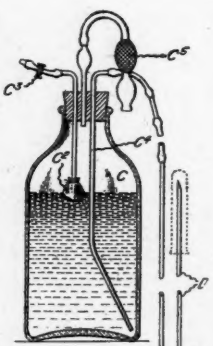

Fig. 4.

The illustration shows the apparatus used in carrying out the new method. The apparatus comprises three bottles or containers (or series thereof), *viz.*, a receiving or bleeding bottle "A," a plasma bottle "B" and a returning bottle "C."

In commencing operations the receiving or bleeding bottle (A) is provided with a stopper (A^1) having two holes, through one of which passes a glass tube (A^2) connected by a rubber tube (A^3) to a canula (D). The other hole in the stopper (A^1) is fitted with a glass tube (A^4) having a bulb containing cotton wool to act as a filter and to maintain sterile conditions.

The canula (D) is inserted into the vein of the horse and the blood is withdrawn into the bleeding bottle (A) (Figure I.), within which a small amount of potassium oxalate solution or other anti-clotting agent has been placed. The bottle (A) is continuously agitated whilst the blood is running into it, whereby thorough admixture of the blood with the anti-clotting agent is secured. When the bleeding is completed the cannula (D) is removed from the vein of the horse and is disconnected from the tube (A^2) leading into the bottle, which tube is then closed by means of a plug of cotton wool and leadfoil cap. After the sedimentation of the red cells has taken place (as shown in darker shading in Figure II.) the stopper (A^1) is removed from the bottle (A) and another stopper (A^5) is inserted therein, having a downwardly projecting tube (A^6), which may be adjusted in height for withdrawing the supernatant plasma, leaving the red cells undisturbed. The supernant plasma (as shown in lighter shading in Figure II.) is then passed by means of pressure or suction through the tube (A^6) into the bottle (B). A lime salt is then added to the plasma in the bottle (B) for the purpose of clotting the same and the serum may be separated therein, or more conveniently, the plasma may be transferred to a separate jar in which the plasma is clotted and the serum is expressed from the clot in the usual way. Another stopper (A^7) is now inserted into the bottle (A), having a tube (A^8) which passes down to the bottom of the bottle for the removal of the red cells. This tube (A^8) is connected with a tube (C^1) leading into the returning bottle (C), having a muslin filter (C^2) through which the red cells are filtered. The pressure within the bottle (A) being raised, the red cells are then transferred into the bottle (C) or alternatively, the pressure within the bottle (C) may be diminished and in this way the red cells are all sucked into the returning bottle (C). The bottle (A) is then disconnected from the bottle (C), the connecting tube (C^1) is closed by means of a stopcock (C^3) and the exit tube (C^4) is connected with the cannula (D). Pressure is then applied to the bottle (C) by bellows (C_5), whereby the red cells are forced into the cannula (D), which is inserted into the vein of the animal and so the red cells are returned to the venous system of the animal.

This new method of "red cell refusion" has been applied in the Commonwealth Serum Laboratories, so that the horse is bled not once per week, as formerely, but at shorter intervals—usually three times per week—for three to five bleedings.

Before giving you a comparison of the two methods, I might mention that for our serum production we use light draught horses or hacks, all of which have been rejected by the Defence Department for bone or other defects. It is to be regretted that precise weights cannot be given of the animals at any stages

of their institution life, as that would have enabled you to form a more precise idea of the effect of various treatments on the physical condition of the animals.

A comparison of the new method with the old method on which it is grafted, will be undertaken under the following headings:—

(*a*) Yields of blood.
(*b*) Yields of plasma.
(*c*) Antitoxic value of the serum.
(*d*) Agglutinin value of the serum.
(*e*) Alterations in the composition of the blood.

Yield of Blood.

Under the new system our record yield until recently was 44 litres of blood. This was taken in seven days (inclusive of the first and last days) from a horse immunized against tetanus toxin. The first three bleedings were each of 12 litres and the last bleeding of 8 litres.

It appeared from the condition in which the horse was left, that we had by no means reached the limit to which the bleeding could be safely carried.

This record was eclipsed in July by the yields of blood of horses 44 and 50, which gave 60 and 58 litres respectively in ten days, as recorded in the following table:—

TABLE "A."

Horse No.	Date of Bleeding.	Quantity Bled.	Plasma Yield.
44	July 19, 1920	12 litres	7.1 litres
	July 21, 1920	12 litres	7.3 litres
	July 23, 1920	12 litres	7.4 litres
	July 26, 1920	12 litres	6.9 litres
	July 28, 1920	12 litres	7.4 litres
		60 litres	36.1 litres
50	July 19, 1920	12 litres	6.15 litres
	July 21, 1920	12 litres	6.30 litres
	July 23, 1920	10 litres	5.75 litres*
	July 26, 1920	12 litres	7.10 litres
	July 28, 1920	12 litres	6.85 litres
		58 litres	32.15 litres

11% increase of plasma between first and last bleedings.
* Calculated on 12 litres, 6.9.

TABLE "B."

All bleedings of eight litres.

Amount of Plasma Recovered.

Horse No.	First Bleeding. Litres.	Second Bleeding. Litres.	Third Bleeding. Litres.
5	5.00	4.85	5.65
9	4.75	5.50	5.95
10	5.10	6.00	6.05
11	4.85	4.95	5.20
15	5.10	5.30	6.10
Total	24.80	26.60	28.95

As illustrative of the yield of the old system let us take the following:—

On the tenth day after the completion of the immunization against diphtheria toxin, a group of five horses were bled, each to the extent of 8 litres. The amount of plasma recovered from the total amount of blood obtained (40 litres) was 24.8 litres. (See Table "B.")

One week later the same five animals were bled again, when from the 40 litres of the blood obtained, 26.6 litres of plasma were recovered.

One week later a third bleeding was taken; from the 40 litres of blood 28.95 litres of plasma were collected; 17% more than on the first bleeding.

We see, therefore, that on the third bleeding 4.15 litres of plasma more were collected than had been the case on the first bleeding; that is to say, the red cell fraction of the blood was steadily diminishing and, although the bleedings had been separated by intervals of one week, the horses were deteriorating. The plasma yield in these figures represents a little less than the total plasma, since in siphoning off the plasma it is important not to take over any red cells. This slight loss, however, was approximately equal in all the cases.

How different is this from the results recorded in Table "C," 1st series, where six horses are shown to have yielded 182 litres of blood in five days, with a rise of plasma yield in the last bleedings of less than 3% calculated on the plasma yield of the first bleeding. In the second series of the same table, an actual fall of plasma is recorded from the third bleedings as against the first, showing that no anæmia occurred during the process.

TABLE "C."

Horse No.	Amount of Blood Taken. May 31, 1920.	Amount of Plasma Recovered. May 31, 1920.	Amount of Blood Taken. June 2, 1920.	Amount of Plasma Recovered. June 2, 1920.	Amount of Blood Taken. June 4, 1920.	Amount of Plasma Recovered. June 4, 1920.	Proportion of Plasma to Total Volume of Blood.
	Litres.	Litres.	Litres.	Litres.	Litres.	Litres.	
36	12	7.55	10	6.70	10	6.00	
38	12	7.30	8	5.25	10	6.35	31/5/20, 0.586
40	10	5.55	10	5.70	10	5.60	
41	10	5.70	10	6.60	10	6.00	2/6/20, 0.637
42	10	5.55	10	6.50	10	5.85	
43	10	5.90	10	6.25	10	6.40	4/6/20, 0.603
Total	64	37.55	58	37.00	60	36.20	

Horse No.	Amount of Blood Taken. June 9, 1920.	Amount of Plasma Recovered. June 9, 1920.	Amount of Blood Taken. June 11, 1920.	Amount of Plasma Recovered. June 11, 1920.	Amount of Blood Taken. June 14, 1920.	Amount of Plasma Recovered. June 14, 1920.	
	Litres.	Litres.	Litres.	Litres.	Litres.	Litres.	
28	10	5.25	10	5.70	10	5.45	
29	12	7.30	12	7.30	12	7.30	9/6/20, 0.597
30	12	7.40	12	7.65	12	6.40	
31	12	7.05	10	5.95	10	5.75	11/6/20, 0.604
33	12	7.40	12	7.55	—	—	
34	12	7.40	12	6.95	—	—	14/6/20, 0.566
Total	70	41.80	68	41.10	44	24.90	

Yield of Plasma.

Owing to the shorter period of sedimentation, usually about two to three hours, under the new method, as against 24 hours under the old method, and also owing to the progressive anæmia of the animals under the old method, the percentage yield of plasma is very distinctly poorer by the new method than by the old.

This is illustrated in Table "D." In the first half (D^1) of that table the quantities obtained from 36

TABLE "D¹."

Showing Percentage Yields of Plasma Obtained Under the Old Method.

Horse No.	Date.	Quantity Bled. Litres.	Plasma Yield. Litres.	Proportion of Plasma to 100.	Time of Sedimentation.
5	April 27, 1920	8	5.25	65.6	Over night
	May 4, 1920	8	6.10	76.2	Over night
	May 11, 1920	8	5.70	71.2	Over night
8	Oct. 20, 1919	8	5.25	65.6	Over night
	Oct. 27, 1919	8	6.05	75.6	Over night
	Nov. 3, 1919	8	5.95	74.3	Over night
9	April 27, 1920	8	4.75	59.3	Over night
	May 4, 1920	8	5.30	66.2	Over night
	May 11, 1920	8	5.20	65.0	Over night
11	April 27, 1920	8	5.50	68.7	Over night
	May 4, 1920	8	5.25	65.6	Over night
	May 11. 1920	8	5.15	64.3	Over night
15	April 27, 1920	8	5.55	69.3	Over night
	May 4, 1920	8	5.90	73.7	Over night
	May 11, 1920	8	6.10	76.3	Over night
28	Dec. 29, 1919	8	4.40	55.0	Over night
	Jan. 5, 1920	8	4.20	52.5	Over night
	Jan. 12, 1920	8	5.50	68.7	Over night
32	Nov. 26, 1919	8	5.60	70.0	Over night
	Dec. 3, 1919	8	5.95	74.3	Over night
	Dec. 10, 1919	8	5.80	72.5	Over night
36	Mar. 29, 1920	8	5.75	71.8	Over night
	April 6, 1920	8	5.95	74.3	Over night
	April 12, 1920	8	6.05	75.6	Over night
40	Jan. 21, 1920	8	4.30	53.7	Over night
	Jan. 28, 1920	8	4.60	57.5	Over night
	Feb. 4, 1920	8	5.15	64.3	Over night
	Mar. 26, 1920	8	4.50	56.2	Over night
	April 1, 1920	8	4.95	61.8	Over night
	April 8, 1920	8	4.80	60.0	Over night
41	Jan. 21, 1920	8	5.25	65.6	Over night
	Jan. 28, 1920	8	5.85	73.1	Over night
	Feb. 4, 1920	8	5.70	71.2	Over night
42	Jan. 21, 1920	8	4.50	56.2	Over night
	Jan. 28, 1920	8	5.70	71.2	Over night
	Feb. 4, 1920	8	5.75	71.8	Over night

Average: 67%.

bleedings of 12 horses by the old method are given, while the second half (D^2) of the table shows the quantities of blood and plasma obtained from 36 bleedings of 12 horses by the new method.

It will be seen that the old method gave 67% of plasma, while the new method gave 60.3%. These averages represent the mean of the percentage yields of each bleeding. An endeavour has been made to evaluate the influence of the two factors in producing this diminution in plasma yields. This has been done by getting the mean percentage yield of plasma of the 12 first bleedings in each group. Since the horses had not been bled for at least two months before, it is quite obvious that the factor of anæmia does not operate, but the factor of shorter sedimentation only.

The mean yield of the 12 first bleedings by the old method was 63.1%, whereas by the new method it was 58.7%, showing that the shorter sedimentation accounted for a loss of only 4.4%. Since, however, the total loss was 6.7%, the balance above the 4.4% must be looked upon as having been due to the anæmic condition in which the animals bled by the old method were, when they were bled on the second and third occasions.

In Table "D" the necessary information is given

TABLE "D²."

Showing Percentage Yields of Plasma Obtained Under the New Method.

Horse No.	Date.	Quantity Bled. Litres.	Plasma Yield. Litres.	Proportion of Plasma to 100.	Time of Sedimentation. Hr. Min.
8	June 9, 1920	9	5.05	56.1	1 40
	June 11, 1920	12	8.30	69.1	1 40
	June 14, 1920	12	7.60	63.3	1 40
28	June 9, 1920	10	5.25	52.5	1 40
	June 11, 1920	10	5.70	57.0	1 40
	June 14, 1920	10	5.45	54.5	1 40
29	June 9, 1920	12	7.30	60.9	1 40
	June 11, 1920	12	7.50	62.5	1 40
	June 14, 1920	12	7.20	60.0	1 40
30	June 9, 1920	12	7.40	61.7	1 40
	June 11, 1920	12	7.65	63.7	1 40
	June 14, 1920	12	6.40	53.3	1 40
31	June 9, 1920	12	7.05	58.7	1 40
	June 11, 1920	10	6.05	60.5	1 40
	June 14, 1920	10	5.75	57.5	1 40
36	May 31, 1920	12	7.55	62.9	1 40
	June 2, 1920	10	6.70	67.0	1 40
	June 4, 1920	10	6.35	63.5	1 40
38	May 31, 1920	12	7.30	60.8	1 40
	June 2, 1920	8	5.25	65.6	1 40
	June 4, 1920	10	6.35	63.5	1 40
40	May 31, 1920	10	5.45	54.5	1 40
	June 2, 1920	10	5.70	57.0	1 40
	June 4, 1920	10	5.60	56.0	1 40
41	May 31, 1920	10	5.70	57.0	1 40
	June 2, 1920	10	6.60	66.0	1 40
	June 4, 1920	10	6.00	60.0	1 40
42	May 31, 1920	10	5.55	55.5	1 40
	June 2, 1920	10	6.50	65.0	1 40
	June 4, 1920	10	5.85	58.5	1 40
43	May 31, 1920	10	5.90	59.0	1 40
	June 2, 1920	10	6.25	62.5	1 40
	June 4, 1920	10	6.40	64.0	1 40
31	April 7, 1920	12	7.80	65.0	2 0
	April 9, 1920	12	7.00	58.3	2 0
	April 12, 1920	8	4.85	60.6	2 0

Average: 60.3%.

TABLE "Q."

Horse No.	Date of Bleeding.	No. of Immunization.	No. of Bleeding.	Quantity Bled. Litres.
30	October 21, 1919	1	1	11.35
	October 23, 1919	1	2	10
	October 25, 1919	1	3	10
38	May 31, 1920	3	1	12
	June 2, 1920	3	2	8
	June 4, 1920	3	3	10
40	May 31, 1920	3	1	10
	June 2, 1920	3	2	10
	June 4, 1920	3	3	10
41	May 31, 1920	3	1	10
	June 2, 1920	3	2	10
	June 4, 1920	3	3	10
42	May 31, 1920	3	1	10
	June 2, 1920	3	2	10
	June 4, 1920	3	3	10

TABLE "Z."

Showing the Fall in Potency of Diphtheritic Antitoxin Obtained in Successive Bleedings by the "Red Cell Return Method."

Date.	No. of Horse (H) No. of Immunization (I) No. of Bleeding (B) Size of Bleeding.	Description of Guinea-Pig.	Anti-toxin.	L + Dose of Toxin. c.cm..	Day 1st	2nd	3rd	4th	5th	6th		Unitage per c.cm. and Percentage Fall of Third Bleeding, Calculated on the First Bleeding.
31/12/1919	H I B 30 1 1 11.35 litres	Brown and white	1/500	+ 0.40	260	—	235	230	S	225	T	
							+					
			1/600	+ 0.40	260	—	260					About 500
	H I B 30 1 2 10 litres	Black and white	1/400	+ 0.40	260	—	240	240	S	250	T	> 400
31/12/1919	H I B 30 1 3 10 litres	Black and white	1/300	+ 0.40	243	—	220	230	S	240	T	
			1/350	+ 0.40	260	260	260	250	250	—	T	About 350
							+					
			1/400	+ 0.40	250	250	240					Fall 30%
2/6/1920	H I B 38 3 1 12 litres	Black	1/600	+ 0.43	250	245	—	250	—	T		Taken as 600
	H I B 38 3 1	White	1/650	+ 0.43	250	245	+					
5/7/1920	H I B 38 3 3 10 litres	Tan and white	1/400	+ 0.43	250	250	220	240	245	T		400
			1/450	+ 0.43	245	245	Dying +					Fall 33%
28/6/1920	H I B 41 3 1 10 litres	White	1/500	+ 0.43	—	—	—	—	—	—		
		White, tan rt. ear	1/550	+ 0.43	—	—	—	—	—	—		
		White	1/600	+ 0.43	250	265	—	265	—	T		650
		Black and white	1/650	+ 0.43	250	245	—	—	250			
						+						
			1/700	+ 0.43	250	250						
	H I B 41 3 3 10 litres	White, tan rt. ear	1/400	+ 0.43	250	245	220	240	250			400
			1/450	+ 0.43	250	230	Dying +					Fall 38%

(Continued on next page.)

TABLE "Z"—*Continued.*

Showing the Fall in Potency of Diphtheritic Antitoxin Obtained in Successive Bleedings by the "Red Cell Return Method."

Date.	No. of Horse (H) No. of Immunization (I) No. of Bleeding (B) Size of Bleeding.	Description of Guinea-Pig.	Antitoxin.	L + Dose of Toxin. c.cm..	Day 1st	2nd	3rd	4th	5th	6th	Unitage per c.cm. and Percentage Fall of Third Bleeding, Calculated on the First Bleeding.
2/6/1920	H I B 40 3 1 10 litres	White	1/600	+ 0.43	240	245	—	245	T	T	..
		Cream, white	1/650	+ 0.43	250	250	+ —				.. 600
		Grey, white	1/700	+ 0.43	—	+ 250					..
10/7/1920	H I B 40 3 3 10 litres	Grey, cream	1/400	+ 0.43	240	—	245	230	—	T	.. 400
		White	1/450	+ 0.43	240	—	+ 220				.. Fall 33%
	H I B 42 3 1 10 litres	Black and white	1/600	+ 0.43	250	250	—	260	—	T	..
		Brown, tan	1/650	+ 0.43	250	245	..	..	250	T	.. 650
		Black, white, tan	1/700	+ 0.43	250	250	+ —				..
10/7/1920	H I B 42 3 3 10 litres	White, black rt. eye	1/400	+ 0.43	240	—	260	240	—		.. 400
		Black, tan, white	1/450	+ 0.43	240	+ —					.. Fall 38%

\+ indicates death.

to enable a comparison of the absolute yields of plasma by the two methods to be made. From this table it is seen that the old method, in thirty-six bleedings, yielded 193.25 litres of plasma and the new method in the same number of bleedings yielded 230.3 litres; that is to say, the yield was increased by 19%.

Of those horses which were bled by the new method, some were bled to the extent of 12 litres, but some to lesser amounts only, hence 19% does not represent the true increase of which the method is capable.

With increasing experience we feel justified in bleeding more profusely; this has given us greatly increased yields of plasma.

If we take Horses 29 and 30 (Table "D^2"), for example, we find that the average yield of plasma per bleeding was 7.24 litres, while the average yield of plasma from the individual bleeding under the old system was only 5.36 litres. This shows a clear gain of 35%. These, however, are only individual horses.

In the latest group of seven horses to be bled for diphtheria plasma, each being bled three times during the interval from the 19th to the 23rd July, the average yield of plasma was 7 litres per bleeding. Three of these horses gave 12 litres of blood on each bleeding and the others on one or more occasions. The average yield of plasma per bleeding by the old method was 5.36 litres (see Table "D"), so that the last group of seven horses bled by the new method showed a clear gain of 30%.

Diphtheria Antitoxin Content of the Plasma Obtained by the New Method.

Table "Q" shows the time and extent of bleedings of several diphtheria antitoxin horses.

Table "Z" indicates the rate of fall of antitoxic content of the plasma from the first to the third bleeding by the new method. From this table it is evident that the average fall in unitage between the first and the third bleeding in the case of horses giving about 600 units per c.cm. on the first bleeding is about 34%.

It may here be remarked that under the old system it was the rule to bleed once weekly until the potency of the serum fell to 300 units per cubic centimetre. This occurred in from one to three—or, exceptionally, four—bleedings of eight litres, depending on the titre of the first bleeding.

Had this rule been followed under the new system, at least one, if not two, further bleedings could have been undertaken in the case of each of the five horses dealt with in Table "Z," showing that the new system is going to allow not only of shorter intervals between bleedings, but also of more frequent bleedings per immunization.

As indicated in Table "A" Horse 44, on the first

immunization, was bled to the extent of 60 litres in 10 days.

The first bleeding gave a diphtheria antitoxin titre of about 900 units and the fifth bleeding gave a diphtheria antitoxin titre of over 400 units, showing a fall of 55%.

Horse 50, after its first immunization, was bled to the extent of 58 litres in 10 days, as shown in Table "A."

The diphtheria antitoxin titre of the first bleeding was 700 units and that of the fifth bleeding was 400 units, showing a fall of 43%.

For comparison, the following figures of a diphtheria antitoxin horse show the rapidity of the fall of potency in a horse bled once weekly to the extent of eight litres, *i.e.*, under the old system:—

Plasma of first bleeding = 900 units;
Plasma of third bleeding = 350 units;

i.e., a fall of 61% occurred between the first and third bleedings.

We see, therefore, that under the old system we took 24 litres of blood in three bleedings from a horse having initially 900 units and falling on the third bleeding to 350 units, whereas under the new scheme a horse having initially 900 units approximately fell to 400 units, this horse giving 60 litres of blood.

The ratio, therefore, of blood volumes derived from the two immunization was as 24:60.

The ratio of plasma volumes derived from the two immunizations was as 16:36.

We see here a clear gain of well over 100%, not to mention that the results were obtained in a much shorter time.

Tetanus Antitoxin Content of Plasma Obtained Under the New Method.

A horse immunized against tetanus toxin was bled on four occasions to the extent of 12, 12, 12 and 8 litres respectively, yielding a total of 44 litres of blood in eight days. The plasma of the last bleeding showed a fall of antitoxin of 54% calculated on the antitoxic content of the plasma obtained from the first of the four bleedings.

Agglutinin Value of the Serum Obtained by Both Methods.

For a comparison of the agglutinin value of the serums obtained by the two methods, the results obtained in the case of two horses immunized against the meningococcus are indicated in Tables "X" and "Y."

It is seen from these tables that in the case of Horse 6 (Table "X") no fall occurred in the agglutinin content to Type I., but the agglutinin content to Type II. fell to about one-fifteenth and to Type III. to one-fourth of the original titre during the interval between the two bleedings.

The highest limit of complete agglutination is taken in each case, and the average percentage loss of agglutinin for the three types is about 56% of the total.

In the case of Horse 17, bled by the new method, the fall in titre is seen to have been nil as between the first two bleedings, although in the case of this horse 23 litres of blood had been taken, while in the

TABLE "X."

Bleeding by the Old Method.

Horse No. 6.—On December 18, 1919, twenty slopes of living meningococcus were administered intravenously, the last dose given in the course of the immunization.

On December 29, 1919, eight litres of blood were drawn and an agglutination test against Gordon's type strains gave the following result:

Horse 6.	Type.	Dilutions 1/50	1/100	1/200	1/400	1/800	1/1600	1/2000	1/3000	1/4000	1/5000	Control.
First Bleeding	1	++	++	+++	+++	+++	++	+	tr	—	—	—
	2	++	++	++	+++	+++	+++	++	+++	+	—	—
8 litres	3	++	+++	+++	+++	+++	+++	+	+	—	—	—
Second Bleeding	1	+++	+++	+++	+++	+++	++	o	tr	o	o	—
(after 7 days)	2	+++	+++	+++	++	—	—	o	—	o	o	—
8 litres	3	++	+++	+++	+++	++	—	o	—	o	o	—

o indicates that no tube was used at that dilution.

TABLE "Y."

Bleeding by the New Method.

Horse No. 17.—On March 10, 1920, twenty slopes of living meningococcus were administered intravenously as a last immunizing dose to Horse 17. Ten days later bleeding was commenced and repeated as indicated hereunder and an agglutination test against Gordon's type strains gave the following result:

Horse 17.	Type.	Dilutions 1/100	1/200	1/400	1/800	1/1600	1/3200	1/6400	Control.
March 3, 1920	1	+++	+++	+++	+	—	—	—	—
First Bleeding	2	+++	+++	+++	+++	+	—	—	—
12 litres	3	+++	+++	+++	+++	++	++	+	—
March 22, 1920	1	+++	+++	+++	+	tr	—	—	—
Second Bleeding	2	+++	+++	+++	+++	++	—	—	—
11 litres	3	+++	+++	+++	+++	++	+	+	—
March 24, 1920	1	+++	++	++	+	—	—	—	—
Third Bleeding	2	+++	+++	+++	+++	++	+	+	—
10 litres	3	+++	+++	+++	++	+	—	—	—

case of Horse 6 only 16 litres had been taken. Even the third bleeding in the case of Horse 17 was of quite good agglutination titre. We see, then, that by the old method Horse 6 gave:—

On the first bleeding 4.55 litres of plasma; and

On the second bleeding 5.45 litres of plasma.

If the loss of agglutinin is 56% calculated on the concentration of the first bleeding, the second bleeding converted into a volume of equivalent agglutinin concentration would be 5.45 litres $\times$ $^{44}/_{100}$, that is, 2.39 litres, so that the two bleedings together might be looked upon as giving plasma equal to 6.94 litres approximately of plasma of the first bleeding.

We also see that under the new method the first bleeding from Horse 17 yielded 7.60 litres of plasma, while the second, which showed no loss of agglutinin, yielded 7.5 litres, so that the volume of plasma in the two first bleedings calculated in terms of the first bleeding is equal to 15.1 litres—a yield more than 100% better than the yield from the two bleedings by the old method.

Another horse (No. 18), yielding 30 litres of blood in six days by the red cell return method, showed practically no fall in the agglutination titre of the third bleeding in comparison with that of the first bleeding.

We have used the method in the preparation of pneumococcal sera and in this case we have found a slight fall to occur in subsequent bleedings in comparison with the first, but we have not adequate material for comparison of the new method with the old in the case of pnemococcal sera.

Staphylococcal serum was made by the immunization of Horse 25. On August 4, 1920, eight days after the last injection of antigen, this horse was bled to the extent of 10 litres and the red cells were returned. One August 6, 1920, it was bled a second time to the extent of 10 litres and again to the same extent on August 9, 1920.

The average agglutination titre of the serum was determined for ten strains of staphylococcus, when it was found that the difference in titre between the plasma derived from the first two bleedings was very slight; it was actually higher in the case of the second bleeding than in the case of the first bleeding to the extent of 17%.

The average agglutination titre of the second and third bleedings was exactly the same.

This result is a little better than that which we got with the meningococcal serum. The improvement, however, is more apparent than real, since in the case of the staphylococcal horse the first bleeding was taken on the eighth day after the completion of the immunization, whereas in the case of the meningococcal horse it was taken on the tenth day.

A horse immunized against the gonococcus was bled in a similar manner and gave very similar results.

Changes in the Composition of the Blood During Bleeding.

The information in this section is chiefly derived from the bleeding of two animals: Horses 22 and 30.

Horse 22 was used as a source of normal serum for some time before the experimental observations recorded were made, while Horse 30 had been immunized against the toxin of *B. diphtheriæ* and was bled after the first immunization three times, then rested for three weeks, then was re-immunized and ten days later was bled three times. The latter bleedings are dealt with in the protocols given.

An attempt was made to determine the relative quantity of red cells in the blood from time to time during the actual bleeding of the horses. Red cell counts were attempted. A sample of these counts given in Table "F" shows that even after much counting, there is an error of very considerable size. The counts were done in this way: Blood was received into special 100 c.cm. cylinders, each cylinder containing 1.25 c.cm. of oxalate solution. Each cylinder was then inverted four times, without shaking, to mix thoroughly the oxalate and blood. After prolonged and careful mixing, a sample was taken and made up to a dilution of 1 in 200 in a suitably diluted oxalate solution in saline solution. The sample was counted in a Thoma-Zeiss chamber. A fresh dilution from the cylinder was taken for every forty squares counted, to avoid the errors of defective mixing, etc..

TABLE "F."

Horse 30.

No. and Date of Bleeding.		First Cylinder.			Seventh Cylinder.	
Second Bleeding January 5, 1920	First	40 squares = 378	1 = 9.45	First	40 squares = 437	1 = 10.9
	Second	40 squares = 351	1 = 8.77	Second	40 squares = 483	1 = 12.1
	Third	40 squares = 305	1 = 7.62	Third	40 squares = 446	1 = 11.1
	Fourth	40 squares = 398	1 = 9.95			
	Fifth	40 squares = 375	1 = 9.37			
		Average = 9.03			Average = 11.3	
		9.03 × 4,000 × 200 = 7,224,000 red blood cells per c.mm..			11.3 × 4,000 × 200 = 9,040,000 red blood cells per c.mm..	

The considerable variations indicated in Table "F" showed that the method had an error of very considerable magnitude. The red cells of horse blood sediment readily and this in all probability contributes to the large error.

It was then decided to try volume measurements of red cell fractions in several 100 c.cm. cylinders of blood, one being taken directly after the others. In this way differences between succeeding cylinders were of the order of not more than 1 c.cm. in respect of the red cell fractions, so that it was decided to use this method exclusively.

O'Brien relied on red cell counts chiefly in doing similar work, though in two cases he employed the two methods side by side. The results, however, were contradictory, so that, for example, after 10 litres of blood had been taken in the case of Horse 11, the red cell count method gave 76% and the volume method 101% of the original content of red cells.

My own results convince me that the red cell count method was in error and that the volume result was probably correct. In two out of five animals where the volume method was applied, the percentage volume of red cells was greater after 10 litres had been bled than it was at the commencement of bleeding, while in three other animals it was not more than 7% less. In Horse No. 1 O'Brien found by both red cell count and volume methods a fall without any marked rise towards the end of the bleeding. This is quite unlike my results. The detailed results of the volume method are set out in Table "M." The general results are:—

Firstly an initial fall in red cells, reaching its maximum after 4 to 6½ litres litres had been taken. The fall in the case of one horse out of the five (Horse 30, second bleeding), was so slight as to be negligible, but in the other four horses it was very marked.

Secondly after the minimum is reached a second phase sets in, in which the red cells concentrate until they attain a volume about equal to or even very considerably in excess of the initial percentage volume.

These results are illustrated in Figure V..

The first pheno-

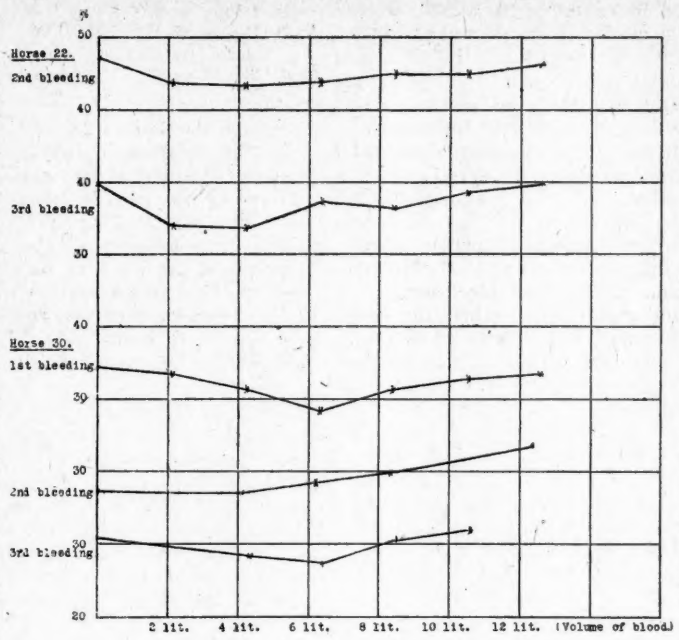

FIGURE V.

TABLE "M."

Horse No.	No. and Date of Bleeding.	Reading from Cylinders After Standing 24 Hours. Total Volume in c.cm.	Red Blood Corpuscles in c.cm.	Time of Taking the Sample of Blood from which the Plasma was derived.
22	B 2 December 19, 1919	1 100	47.23	At commencement of bleeding
		2 100	43.85	After taking 2.1 litres
		3 100	43.27	After taking 4.2 litres
		4 100	43.78	After taking 6.3 litres
		5 100	45.01	After taking 8.4 litres
		7 100	44.97	After taking 10.6 litres
		10 100	46.10	After taking 12.8 litres
22	B 3 December 22, 1919	1 100	39.90	At commencement of bleeding
		2 100	34.06	After taking 2.1 litres
		3 100	33.63	After taking 4.2 litres
		4 100	37.28	After taking 6.3 litres
		5 100	36.37	After taking 8.4 litres
		6 100	38.53	After taking 10.5 litres
		7 100	39.60	After taking 12.6 litres

CONTINUATION OF TABLE "M."

Horse No.	No. of Immunization and No. and Date of Bleeding.	Reading from Cylinders After Standing 24 Hours. Total Volume in c.cm.	Red Blood Corpuscles in c.cm.	Time of Taking the Sample of Blood from which the Plasma was derived.
30	I B 2 1 January 2, 1920	1 100	34.45	At commencement of bleeding
		2 100	33.40	After taking 2.1 litres
		3 100	31.34	After taking 4.2 litres
		4 100	28.40	After taking 6.3 litres
		5 100	31.10	After taking 8.4 litres
		6 100	32.51	After taking 10.5 litres
		7 100	33.25	After taking 12.6 litres
30	I B 2 2 January 5, 1920	1 100	27.38	At commencement of bleeding
		3 100	27.00	After taking 4.2 litres
		4 100	28.43	After taking 6.3 litres
		5 100	29.59	After taking 8.4 litres
		7 100	33.40	After taking 12.6 litres
30	I B 2 3 January 9, 1920	1 100	30.80	At commencement of bleeding
		3 100	28.30	After taking 4.2 litres
		4 100	27.60	After taking 6.3 litres
		5 100	30.30	After taking 8.4 litres
		7 100	31.90	After taking 10.6 litres

TABLE "K."

Variations of the Specific Gravity of the Plasma During Large Bleedings.

Horse No.	No. and Date of Bleeding.	Cylinder No.	Specific Gravity of Plasma.	Time of Taking the Sample of Blood from which the Plasma was derived.
22	B 3 December 22, 1919	1	1020.6	At commencement of bleeding
		2	1019.1	After taking 2.1 litres of blood
		3	1018.8	After taking 4.2 litres of blood
		4	1018.2	After taking 6.3 litres of blood
		5	1018.3	After taking 8.4 litres of blood
		6	1018.3	After taking 10.5 litres of blood
		7	1018.3	After taking 12.6 litres of blood
30	B 2 January 5, 1920	1	1025.0	At commencement of bleeding
		3	1026.0	After taking 4.2 litres of blood
		4	1026.7	After taking 6.3 litres of blood
		5	1026.5	After taking 8.4 litres of blood
		7	1026.0	After taking 12.6 litres of blood
	B 3 January 9, 1920	1	1026.5	At commencement of bleeding
		3	1025.0	After taking 4.2 litres of blood
		4	1024.6	After taking 6.3 litres of blood
		5	1023.6	After taking 8.4 litres of blood
		7	1024.5	After taking 10.6 litres of blood

menon is due to an attempt on the part of the animal to maintain the blood volume by replacing lost blood by lymph; the second seems to be similar to that which is seen in shock, where, the blood vessels becoming more pervious, the plasma escapes and the red cells concentrate.

The maximum fall in red cell volume does not appear to be more than about 6% calculated on the volume of blood taken, or 17% calculated on the initial volume of the red cell fraction (Horse 30, first bleeding).

The maximum rise in the second phase, found with 12 litre bleedings, was observed to occur in the case of Horse 30 (second bleeding), where a rise of approximately 6% of red blood cells occurred, calculated on the volume of blood examined, or expressed as a percentage increase on the initial volume of red cells present it equalled approximately 22%.

For comparison with the figures given in Table "M" six 100 c.cm. cylinders of blood were taken from a horse during one bleeding. These cylinders were allowed to stand for an hour and a quarter, when quite a marked separation of red cell fraction from plasma fraction was visible. The average quantity of red cell fraction in the six 100 c.cm. cylinders was 48.3 c.cm.. These same cylinders were allowed to stand overnight and a fresh reading was taken next day, when it was found that the average quantity of red cell fraction was 45.2 c.cm., showing a loss of 3.1 c.cm. of plasma per 100 c.cm. of blood. This figure is slightly less than that which we obtained in our bulk production work.

Changes of Specific Gravity of Plasma During Bleeding.

All specific gravities of the plasma were taken at 37° C. by the Westphal balance. The cylinders were all allowed to stand in a water bath for half an hour before the readings were taken.

It appears from Table "K" that in two cases the specific gravity fell during the early portion of the bleeding. This fall was due, doubtless, to the fluid entering the blood stream being poorer in solids than the normal plasma. In one case, however, the specific gravity showed no fall, but rather a slight rise during the early stage of the bleeding; it was precisely in this bleeding that the fall of the red cell content of the blood was negligible. Each of these two facts supports the view that for some reason or other no definite influx of fluid into the circulatory system occurred in this horse (Horse 30) during the early stage of this bleeding.

Plasmopenia.

It is evident that a horse which has been bled to the extent of 30 or 36 litres and to which the red cells have been returned, must suffer from plasmopenia. It is not, however, easy to detect the condition. The specific gravity of the plasma of the first, second and third bleedings of the first cylinders from each bleeding was in the case of Horse 22, 1,023, 1,020 and 1,020 respectively, so that the specific gravity of the plasma is unsuitable as an indication of the condition.

Horse 22 was bled on December 17, 1919, to the extent of 10.15 litres and on December 19, 1919, and December 22, 1919, to the extent of 12.8 litres and 12.6 litres respectively. Estimations of the plasma proteins gave the results which are set out in Table "S."

TABLE "S."

Total Protein Determinations by the Refractometer Method.

Horse No.	No. and Date of Bleeding.	Quantity Bled. Litres.	Total Protein.
22	B 1 (Triplicate readings) December 17, 1919	10.1	7.83%
	B 2 December 19, 1919	12.8	7.39%
	B 3 December 22, 1919	12.6	6.99%
	B 4 December 30, 1919	Sample	6.2%

Protein Percentages.

In using the refractometer method samples of plasma were diluted 1 to 1 with $^1/_{25}$ normal acetic acid. The refractive values before and after boiling were taken with the Zeiss refractometer. The difference in the readings was taken to be due to the coagulation of the protein present in solution and the estimate of the protein present was obtained by the use of a factor devised by Reiss and used in this particular class of work by Homer for relative values only.

It is seen from a comparison with nitrogen determination methods that it gives results considerably below the true values.

In doing the nitrogen determinations, Robertson's method was employed. The plasma protein was coagulated by dropping into absolute alcohol. The precipitates were washed with alcohol, then with ether and dried for several hours at 40° C..

Nitrogen determinations by Kjeldahl's method were carried out and the protein was calculated on them on the assumption that its nitrogen content was about 15.9%. This value was adopted by Abderhalden, Hammarsten and Robertson.

In addition, nitrogen determinations of the whole plasma were made by the Kjeldahl method. In this case no alcoholic precipitation was carried out, nor any drying.

The protein determinations are set out in Tables "S" and "O."

TABLE "O."

Refractometer Readings.

No. of Horse. No. of Immunization. No. of Bleeding.	Time When Reading Was Taken.	Scale Divisions.	Protein.
H I B 50 1 1	Before boiling After boiling	42.5 22.5	8.7%
		20.0	
H I B 50 1 5	Before boiling After boiling	36.9 22.55	6.2%
		14.35	
H I B 44 1 1	Before boiling After boiling	40.0 22.25	7.7%
		17.75	
H I B 44 1 5	Before boiling After boiling	33.7 22.25	4.94%
		11.45	

The total amount of blood taken in five bleedings from Horse 50 was 58 litres and from Horse 44 60 litres.
In all the above protein values the Homer factor of 0.2175% per scale division was used in computing results.

Nitrogen Determinations.

Alcohol Precipitations.		Whole Plasma Used.	
H I B 50 1 1	2 c.cm. sample .. 10.06% protein	H I B 50 1 1	3 c.cm. sample .. 10.4% protein
H I B 50 1 5	2 c.cm. sample .. 6.90% protein	H I B 50 1 5	3 c.cm. sample .. 7.4% protein
H I B 44 1 1	2 c.cm. sample .. 9.3% protein	H I B 44 1 1	3 c.cm. sample .. 9.4% protein
H I B 44 1 5	2 c.cm. sample .. 6.75% protein	H I B 44 1 5	3 c.cm. sample .. 7.1% protein

The figures in Table "S" suggest that a horse which had been bled to the extent of about 36 litres, shows such small changes in the protein content of its plasma as to indicate the need for working on animals in which the plasmopenia was considerably more acute.

In Table "A" a statement of the bleedings of Horses 44 and 50 respectively shows that these horses must have had very acute plasmopenia. It was, therefore, determined to make protein estimations by both the refractometer and the nitrogen determination methods, the results of which examinations are recorded in Table "O."

From that table we see that Horse 50, although it had lost 32 litres of plasma in the course of five bleedings during 10 days, had lost only 28% of its protein by the refractometer method, whereas by the nitrogen determination of the alcoholic precipitate the loss was 31%.

In the case of Horse 44, on the other hand, which had lost 36 litres of plasma in five bleedings, each of 12 litres, taken during the 10 days, the percentage of protein calculated by the refractometer method fell 36% and by the nitrogen determination method 27%.

These falls are outside the variations to which normal horses are subject in respect of the protein content of their blood and may be looked upon as slight but definite evidence of plasmopenia.

I would like to take this opportunity of acknowledging my indebtedness to Mr. F. J. Considine for these protein determinations.

The disadvantages of the new method are:—

Firstly, that we have to pierce the vein twice on each day of bleeding; on one occasion for withdrawing the blood and on the second occasion for returning the red cells; and

Secondly, that we lose about 4% of plasma owing to our shorter sedimentation. That has been fully dealt with in a previous section on the subject of yields of plasma.

With regard to the first disadvantage, in view of the fact that we find it perfectly safe to take 12 litre bleedings, this disadvantage is not so serious as it appears, because from a 12 litre bleeding yielding 60% of plasma we get 7.2 litres of plasma, whereas under the old method, where the red cells were not returned, our bleedings were limited to 8 litres and

they were taken weekly. These 8 litre bleedings gave us approximately 5.3 litres of plasma. Therefore, in terms of plasma obtained from the animal, we require only slightly more than 1½ times the number of venous punctures which obtained under the old method.

In the case of the meningococcal horses compared the number of venous punctures to antibody yield is no greater under the new method than it was under the old.

Time of Bleeding.

It has been tried to bleed on two occasions during the one day, that is to say, 12 litres of blood have been taken from a horse in the morning and about four hours later the red cells were returned; while the cannula was yet in the vein an endeavour was made to bleed the animal a second time. The blood flow, however, was not satisfactory. It was slow and intermittent, so that after four litres had been removed, it was decided to interrupt the operation.

The present position is that while bleedings on alternate days have given us every satisfaction, it is possible that they do not represent the optimum time. If, for example, the red cells could be taken on one day and returned on the next, immediately before commencing the bleeding, it is possible that better results might be obtained and the number of necessary punctures diminished. This, however, is a matter of detail and will be investigated at a later date.

The Possible Value of the Method for the Treatment of the Human Subject.

In view of the fact that such large quantities of plasma can be taken from the horse without affecting its general health to any serious extent, the possibility of using the method for the treatment of man arises naturally in one's mind.

Up to the present the amount of convalescent serum available for the treatment of actual cases of disease has been strictly limited. Usually the medical man feels that the bleeding of a convalescent patient to any extent is not justifiable, but our experience in the case of the horse suggests to us that this attitude might very reasonably be modified and by returning the red cells of the blood to the convalescent patient large quantities of plasma might be taken from him without any serious injury to his health. By this method the use of convalescent serum might be tried on a really extensive and practical scale for the treatment of those diseases which are known to be infective, but of which we have not yet isolated the infecting organism.

Moreover, in poisoning it seems reasonable to believe that if the plasma of the blood were removed and the red cells were returned in gum solution and if this were repeated frequently enough, very valuable results would accrue.

On the physiological and pathological sides the use of the method should enable us to investigate the question of the repair of the plasma and also to ascertain what pathological changes in Bright's disease, for example, might be attributable to the loss of blood proteins through the defective kidneys.

The Safety of the Operation.

In the month of June of this year 20 horses were bled by the new method, the total number of bleedings and refusions being 47. All the animals supported the operation well. We have seen no case of embolus, high temperature, abscess, septicæmia or signs of intoxication from the oxalate after the operation.

Experimentation with the method has been going on at the laboratories since last year and on only one occasion has there been an accident. At about the end of an operation, the cannula once slipped from the vein and a few of the red cells were inadvertently injected into the subcutaneous tissue.

Conclusions.

The conclusions that I have drawn from the use of this method are as follows:—

Firstly: Owing to red cell refusion alone and without any artificial restoration of the blood volume, a horse may be bled to an enormous extent without any serious detriment to its physical condition.

Secondly: The red cells so returned to the horse persist and function, so that after 60 litres of blood have been taken from the horse in the course of ten days and the red cells have been returned, no anæmia has resulted.

Thirdly: Red cell refusion can be profitably applied to the production of therapeutic sera. Under the system which I have described to you, a small fall in the percentage yield of plasma occurs, but owing to the larger and more frequent bleedings a very great increase in the absolute yield of plasma results.

Fourthly: Owing to the fact that the bleedings may be heaped up about the period of maximum antibody content of the blood, the potency of the serum derived from the plasma is greatly improved. The antibody yield may be increased to even more than 100% per immunization.

Fifthly: During the bleeding of the horse to the extent of 10 or 12 litres, two well-defined phases of red cell content occur, a first phase in which the red cell content falls and a second phase in which the red cell content rises.

Sixthly: Specific gravity determinations are unsuitable for the detection of plasmopenia.

Seventhly: Protein determinations are not of much use for the detection of the condition, unless it be very aggravated.

I desire to express my thanks to Mr. R. A. Newton for his energetic help in the early experimental development of this work.

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A meeting of the International Committee of Public Health will be held in October, 1920, in Paris. This Committee was appointed as a result of the International Treaty of 1912. We understand that the subjects for special discussion will include the question of the regulations governing international quarantine, the prophylaxis of venereal disease among sailors and general hygienic problems affecting the mercantile marine. The Commonwealth of Australia will be represented by Dr. W. P. Norris, formerly Director of Quarantine.

The Medical Journal of Australia.

SATURDAY, SEPTEMBER 25, 1920.

The Control of Hospitals.

The Australasian Medical Congress and the Federal Committee of the British Medical Association in Australia have had the subject of the relations of the public hospital and the medical profession under consideration for several years. A definite policy has been established. Notwithstanding the clearly defined attitude of the medical profession, there exist at the present time within the Commonwealth institutions known as hospitals constituted, controlled and managed on such divergent lines that we are led to suggest further action to effect something approaching uniformity. It is scarcely necessary to recall that between the Royal Prince Alfred and the Melbourne Hospitals at the one end of the scale and the Hobart General Hospital at the other, there are innumerable variations in the conditions of admission of patients and in the manner in which the honorary and resident medical staffs are appointed. Difficulties arise from time to time concerning the proper attitude which medical practitioners should adopt toward the public hospitals. These difficulties are to a large extent dependent on the lack of uniformity of hospital management. The introduction into the Victorian Legislative Assembly on August 4, 1920, of the *Hospitals and Charities Bill*, together with the action of various State Governments in taking over the military hospitals from the Department of Defence, has tended to focus medical attention to some urgent matters in connexion with this subject. Both the Victorian and the New South Wales Parliaments recognize that the charitable basis of public hospitals should be safeguarded. The hospitals are intended for the care and treatment of persons whose means do not permit them to secure this care and treatment at current rates outside. The State Treasurer, the Honourable W. M. McPherson, refused to allow members of the Legislative Assembly to drag from him an admission that the persons for whom the public hospitals are intended, can justly be described as destitute. The test of suitability for admission is merely whether the patient can afford to pay for the necessary nursing and medical treatment. In these days of high prices, many people with relatively small incomes can just manage to keep out of debt until illness overcomes them or those dependent on them. It is obvious that a prolonged illness or a major operation must involve an expenditure of money out of the reach of these persons. The hospital is the proper place for them. In the speech of the Treasurer on the motion for the second reading of the *Hospitals and Charities Bill*, a large amount of argument was introduced concerning the provision of nursing and medical treatment in institutions for persons who were able to pay a limited amount and who should therefore be excluded from the hospitals provided for the poor. He had ascertained from the Council of the Victorian Branch of the British Medical Association that no objection would be taken to the establishment of intermediate hospitals conducted on lines similar to those of St. Chad's Hospital, Birmingham, provided that they are controlled by the medical officers of these hospitals. The proposal to introduce inclusive fees in intermediate hospitals is strenuously opposed. The medical profession, however, will not assist the Government in conducting intermediate hospitals, unless these hospitals are controlled in the manner indicated in the resolutions of the Australasian Medical Congress, Melbourne, 1908. The Government of Victoria proposes to establish a Hospitals and Charities Board with small medical representation to exercise a powerful control over all hospitals. In the event of difficulties the Minister is to have the power of the determination of policy and of method of control. It is suggested that the intermediate hospitals shall be private institutions, if possible, but if private individuals do not care to provide money and gratuitous work for institutions subject to departmental control, or the control of a statutory body, the Government will consider the question of establishing intermediate hospitals.

In the case of the nationalized military hospitals, there is the question of the form of control and that of the method of appointment of the medical officers. There is further the large question of whether the medical officers should render service in an honorary

capacity or whether they should become civil servants. These and similar matters need the immediate attention of the medical profession. It is highly desirable that a definite policy should be enunciated and that the profession should be guided in regard to the action that should be taken as each impasse arises. It is necessary that medical officers should be warned against the useless and dangerous expedient of resignation, which not only deprives them of the opportunity of justifying a position that they find it advisable to adopt, but which also places them in a false position in their relation to the public. In any deliberations on these matters, it will be necessary to examine the several issues in connexion with the public interest. Political control may be regarded as advantageous in certain directions and disadvantageous in others. It is only when all the factors have been carefully assessed at their proper value that we can arrive at a wise decision.

THE MENTALITY OF YOUNG DELINQUENTS.

Notwithstanding a very great deal of study and of ingenious suggestion, our understanding of the relationship between criminality and mental defect remains unsatisfactory. Various attempts have been made to overcome the difficulty by the elaboration of definitions acceptable to the lawyer. These attempts are necessarily futile, because the clothing of ignorance in words does not bring us nearer to the truth. The fault obviously lies in the fact that psychology, like metaphysics, has been allowed to depend on guesses rather than on immutable facts, capable of expression with mathematical exactness. Until the psychologist is primarily a physiologist and until mental processes are analysed in physical and chemical terms, progress is unlikely to be attained. Some interesting information is gathered from time to time as a result of observations on persons who have been convicted of offences and on children whose progress in school is slower than the average. These observations provide facts on which physiological study may be based. For this reason we find it advisable to refer to the results of an investigation by Dr. John M. Ahern, Medical Officer of His Majesty's Borstal Institution.[1] The author admits that his investigations are incomplete and that they are complicated by certain invalidating factors. During the period of the inquiry 928 young persons of ages ranging between 16 and 23 years were under control. These juvenile adult delinquents are supposed to be physically and mentally normal. In practice, however, slight physical and mental defects do not preclude committal to the Institution. During the war many even low grade mental defectives were so committed. Provision is made under the *Mental Deficiency Act* for the certification of undoubted defectives. It therefore appears that the proportion of delinquents in the Borstal Institution who are found to be mentally defective, is not a true index of the frequency of mental deficiency among the criminally disposed young persons of the community. Dr. Ahern points out that the inmate of the Institution is given an opportunity of reducing his sentence by good behaviour. The mentally deficient are often incapable of controlling their behaviour in order that they may regain their freedom the sooner. Consequently there is a tendency for a concentration of the mentally deficient in this class of penal establishment. Over 90% of the inmates have been guilty of repeated offences. As a result of his inquiry, he found that 37 could be certified with out further ado under the *Mental Deficiency Act*. There were eleven others who were regarded as undoubtedly mentally defective, although for certain reasons they were not certified. In addition 20 out of 30 youths who had to be removed on account of continued misconduct, were probably mentally defective. Again, Dr. Ahern finds that 20 other inmates are in his opinion certifiable. Including four who were certified as insane, the total number of mental defectives was 92 or approximately 10%. These figures do not include border-line cases nor those individuals whose mentality shows varying defects. He distinguished sharply between defect of intelligence, defect of emotion and defect of moral sense. The level of intelligence of many of the abnormal delinquents was scarcely, if at all, below the average. Of course, there were the typical instances of the boy of 16 with a mental age of 12. Boys with emotional defect may be of considerable intellectual ability. The emotional defect manifests itself in the fact that the disordered behaviour is purposeless. The vicious individual commits an offence for a material gain or for the gratification of a desire. He learns from experience and weighs the chances of success before repeating a wrong act. The normally minded delinquent does not attempt to abscond, because he soon learns that the chances of success are practically nonexistent. The defective individual does not pause to consider; he acts on impulse and consequently it is not surprising to find that all the absconders were mentally deficient. Dr. Ahern has made some valuable observations concerning the epileptoid nature of the outbursts of violent behaviour and of the commission of destructive acts by these defectives. The mere facts that these attacks are recurrent and that previously expressed contrition and even remorse do not influence the repetition, must be accepted as evidence of a departure from a normal physiological process. There is additional evidence in support of the claim that much of the wrong doing in the world is associated with a real mental defect. The boys with emotional defects suffered frequently from twitchings of facial muscles, inco-ordination and other definite signs of nervous disturbance. The height of mentally deficient boys was found to be considerably below the average. In discussing the condition of those with what is known as moral defect, Dr. Ahern adduces some evidence to demonstrate that disciplinary treatment, punishment and even long-continued

[1] *Lancet*, July 10, 1920.

control are quite useless in effecting an improvement. While the normal child or boy can be transformed into a law-abiding citizen by removal from bad companions and by training under strict discipline, the morally defective individual remains uninfluenced. Of the 37 certified boys, no less than 7 were morally depraved. Surely this might be taken as a good starting point for a profound investigation into the real physical basis of this form of mental defect. If definite facts concerning the developmental defect in these individuals could be produced, no difficulty would be experienced in devising a proper method of dealing with them. The gain to the individual and to the community would be immeasurable.

X-RAY TREATMENT OF EXOPHTHALMIC GOÎTRE.

The inhibitory effect on cell growth produced by irradiation together with the atrophic change in highly specialized cells and the development of fibrous tissue has formed the pathological basis for the treatment of conditions of increased thyreoid activity by Röntgen rays.

As the ætiological basis of exophthalmic goître is still imperfectly understood, it follows that the results of the methods of treatment at present adopted in this obscure disease cannot be regarded as entirely satisfactory in all cases. Were the symptoms of Graves's disease purely the result of an increased activity or a morbid process affecting the thyreoid gland *per se*, the indications for treatment might be comparatively simple. The tendency of thought in modern medicine is to regard the increased activity of the thyreoid as probable evidence of a profound disturbance of the normal functions and correlation of the endocrine glandular system as a whole, involving also the sympathetic nervous system. If this conception of the ætiology be correct, it is evident that the removal of a smaller or larger portion of the thyreoid gland in cases of exophthalmic goître might be calculated to bring about a successful result in so far as a diminution of thyreo-toxicosis is concerned. The underlying cause the disease which produces the increased activity of the thyreoid, might still remain in existence. It is for this reason that many authorities have advocated the primary removal of diseased tonsils and septic foci in general, on the assumption that an infective basis not infrequently underlies the morbid process. It is contended by some that exophthalmic goître is a self-limiting disease, which, if not rapidly fatal, has a tendency to run a definite course, leading to spontaneous amelioration after a period of five or six years, during which time a cyclical exaccerbation and remission of thyreoid activity may frequently be observed.

Dr. M. J. Hubeny in discussing the value of X-ray treatment points out that it is obviously a matter of considerable difficulty to determine the value of any form of treatment.[1] The use of irradiation in this condition dates back to the year 1905. Since that time this method has been followed by many prominent radiologists and clinicians. It is perhaps as yet too soon to form a final judgement of the results obtained by this means as compared with other methods of treatment. It is gratifying to note that many observers have recorded amelioration and apparent cure in a large percentage of cases.

Experimentally it has been shown possible to destroy the glandular structures by subjecting them sufficiently to the action of Röntgen rays. It is also known that the more highly organized types of cell and the lymphoid tissues are especially vulnerable to the destructive action of X-rays. Provided the amount of rays sufficient to destroy the gland is not so great as to produce an injurious effect upon the skin, it should be possible to destroy the function of all or a part of the gland in this way and to produce results comparable to those achieved by thyreoidectomy without the dangers connected therewith. It is a matter of clinical experience that the thymus gland is not infrequently enlarged in cases of exophthalmic goître and many contend that irradiation of the thymus should form part of the treatment.

In considering the treatment of a patient suffering from exophthalmic goître it is obvious that very careful consideration is required to determine the particular method most suitable for each individual case. It is possible that laboratory tests, such as the determination of basal metabolism, may become more widely adopted as a means for estimating the degree of thyreoid activity and may serve as reliable guides to the particular method to be employed. Operative interference is usually regarded as contra-indicated during the stage of acute toxic symptoms. Irradiation would appear to be of very definite value in reducing the degree of activity of the gland without the risks involved in operative performances at this stage.

With the advent of a more thorough knowledge of the pathology and physiology of the disease, the exact field of usefulness for the various forms of treatment has still to be accurately defined.

[1] *Illinois Medical Journal*, June, 1920.

THE DEAN OF THE FACULTY OF MEDICINE AT SYDNEY.

A few months ago the first Dean of the Faculty of the University of Sydney passed hence, to the great regret of all who had followed the development of the largest of the Australian schools of medicine. A few months later his successor was appointed. Within a short time, however, the new Dean, Professor J. T. Wilson, received a call from the ancient University of Cambridge.

At its meeting on September 15, 1920, the Faculty of Medicine appointed Professor A. E. Mills to the vacant office of Dean. Thus, within seven months the deanship which had been held by one man for over 36 years since the foundation of the School, has now found its third occupant.

The appointment of Professor Mills is a very popular one. In the first place, he is a graduate of the University of Sydney. In the second place, he has but recently been appointed the first Professor of Medicine in Australia. In the third place, his professional attainments, his wide knowledge of men and matters contribute to this popularity. The task of the new Dean will be by no means an easy one. Medical education has arrived at a parting of the ways. A broad outlook, ability in administration and power of adaptation are needed for the wise control of the School in the immediate future. We have no doubt but that Professor Mills will discharge his duties to the advantage of the School over which he now presides and for the benefit of Australian medicine. We offer him our heartiest congratulations.

Abstracts from Current Medical Literature.

THERAPEUTICS.

(100) Action of Digitalis in Auricular Fibrillation.

E. Canby Robinson (*Amer. Journ. Med. Sciences*, January, 1920) has recently published the results of an investigation of the rapidity and persistence of the action of digitalis on hearts showing auricular fibrillation. The fact that digitalis requires many hours or even days to affect the heart when given in the usual doses, has been the chief disadvantage in the use of this drug in cases of heart disease in which prompt action is urgently indicated. The period of time during which the drug remains effective after its administration is stopped, has frequently been the subject of discussion. This point has an important bearing on the so-called cumulative action of digitalis. To obtain information on these matters the effect of a large single dose of digitalis has been observed in a selected group of patients suffering from a form of cardiac disorder, which is definitely influenced by the drug. In all the cases studied it was demonstrated by electro-cardiograms that auricular fibrillation or auricular flutter was present; in all the ventricular rate was abnormally rapid. Care was taken to insure that the patients were not already under the influence of digitalis when the large test dose was administered. Digitalis was given by the mouth in the form of tincture and the dose was regulated according to the method worked out by Eggleston. The underlying principle of this method is to give in one or several frequent doses the entire amount of the drug which may be expected to produce the maximum therapeutic effect. On this basis the dose employed was equivalent to 0.36 c.cm. per kilo of body weight. The doses given ranged from 15 c.cm. to 25 c.cm. of the tincture. In some cases the entire amount was given as a single dose; in others the dose was divided into three or more parts, which were given at intervals of four to six hours. Twenty-six cases were studied and the results tabulated. The drug was considered to have affected the heart when the ventricular rate first became slower than it had been at any time and when the ventricular slowing continued so that the rate of the ventricles assumed a definitely new level. In two cases of auricular flutter the disappearance of flutter as demonstrated by electro-cardiograms was taken as evidence of digitalis action. The maximum effect of digitalis was considered to have occurred when the ventricles attained approximately their slowest rate and when the pulse deficit had disappeared or had reached its lowest count. The charts of the 26 cases studied indicated that there was some difference in the length of time required for a single large dose of digitalis to produce the maximum effect on cases of auricular fibrillation. In 19 cases the maximum effect of the drug occurred in from 15 to 26 hours. In six cases the maximum effect appeared in from six to nine hours. The cause of the difference in the two groups of cases was not apparent. To determine the length of time during which the drug controlled the heart, the patients were kept constantly in bed and the ventricular rate counted by the stethoscope several times a day. When the ventricular rate began to accelerate and the pulse deficit to increase, the drug was considered to have begun to be ineffectual. At this time another dose of digitalis, usually half the amount originally given, was followed by a prompt fall in the ventricular rate. In 12 cases in which the time when the drug began to be ineffectual was clearly indicated, digitalis affected the heart for from four to fifteen days, the effect lasting on an average about nine days. The study of these cases has demonstrated that single large doses of digitalis affect the heart in cases of auricular fibrillation or flutter at a relatively constant time after administration in from two to five hours, indicating that the drug is absorbed from the alimentary tract at a fairly rapid and uniform rate. The maximum effect on the heart is usually obtained in about 24 hours and the drug generally continues to be effectual for from four to fifteen days, on an average for nearly ten days.

(101) Intravenous Injection of Mercury Bichloride.

The intravenous administration of mercury bichloride in syphilis and other chronic infections is reviewed by Carl H. Bastron (*Amer. Journ. of Med. Sciences*, July, 1920.). Mention is made of previous references to this method of treatment in the literature in which good results have been claimed in the treatment of syphilis, chronic malaria, erysipelas, gonorrhœal arthritis and certain acute infections. The technique of injection described is simple. The mercury bichloride is dissolved in normal saline solution, 10 c.cm. of the solution containing 0.1 gramme of the drug. The solution may be kept in glass stoppered bottles or may be distributed in ampoules in amounts of from one to five c.cm.. Treatment is begun with 1 c.cm. of the solution containing 0.01 gramme of mercury bichloride. The solution is injected slowly into a vein. The advantages claimed for this method over the other modes of mercurial administration are that quicker results in treatment are obtained and a more accurate gradation of dosage is rendered possible. The procedure is regarded as comparatively safe, painless and free from alarming reactions, provided that simple precautions are observed. It is particularly important that the needle should enter the vein perfectly and that none of the solution should be injected into the tissues outside the vessel. In this way phlebitis and venous thrombosis with its attendant dangers can be avoided. The solution used should not be unduly concentrated, since contraction of the vein leading to thrombosis has been observed to follow the use of concentrated solutions. It is recommended that treatment should be begun with a small dose, not exceeding 1 c.cm. of the solution; the dose should be gradually increased with succeeding injections, which are to be given every other day or three times a week. Treatment is continued until signs of mercurialism appear, when the injections are reduced to one or two per week. It is well recognized that mercury bichloride is an exceedingly toxic and corrosive substance; it could not be used intravenously were it not immediately converted into a non-corrosive albuminate. The one serious drawback to the intravenous injection of mercury is the occurrence of thrombosis in the injected veins. This method of treatment is to be regarded as applicable when quick results are urgently desired and when the slight chance of embolism is outweighed by the necessity of putting the patient rapidly under the influence of mercury.

(102) Therapeutic Effects of Mercury on the Kidneys.

L. E. Beinhauer (*Amer. Journ. of Med. Sciences*, June, 1920) has recently studied the effects which follow the internal administration of calomel. The object of the recorded experiments was to calculate the period of time over which the drug was excreted and to study its action upon the kidney as determined by urinary findings. The method employed in these experiments for the detection of mercury embodies the use of copper dust in an acid solution of the suspected material. The mercury is taken up entirely by the copper dust, which is then collected, dried and heated in the end of a bulb tube. The mercury is thus vapourized and deposited as an amalgam in a small particle of gold leaf. By this method it is claimed that very minute particles of mercury in solution may be detected microscopically. An interesting observation was made in establishing controls for these experiments, in that many patients were found to be unsuitable, because they were not mercury free. The majority of such patients were found to have received previous anti-syphilitic treatment entailing the use of mercury in one of its various forms. It is stated that mercury can be found after several years in the urine of patients who have previously received this drug. Suitable controls having been selected, tests were performed after the internal administration of calomel in the usual medicinal doses 0.125 to 0.2 gramme. The urine was collected at intervals from six hours to six days. It was found that in all cases mercury was detected on the second day. There was a greater excretion of the drug on the second day than on any other day, the heaviest excretion being between the forty-second and the seventy-second hours. Mercury was detected in some cases as early as the sixth hour and as late as the sixth day. An analysis of the experiments led to the

conclusions that the excretion of calomel in ordinary therapeutic doses begins within six to twelve hours and is continued until the sixth day, depending upon the size of the dose. A small dose of the drug is excreted as rapidly as a larger dose, but over a shorter period of time. As far as could be determined by the analysis of the urine, the drug is excreted without injurious effects upon the kidney.

UROLOGY.

(103) Renal Calculus.

Hugh Lett calls attention to the great variety in size of renal calculi (*The Practitioner*, August, 1920). Moreover, he points out that some calculi cause pain, while others give rise to no symptoms. On rare occasions the pain may be referred to the other side. This has been demonstrated both anatomically and by the aid of X-rays. In discussing whether a so-called silent calculus should be removed or not, he first considers the effects of renal calculi. Calculi invariably cause a diffuse interstitial nephritis. The changes may develope slowly, but eventually the organ becomes converted into a small granular kidney, with serious diminution of its efficiency. Calculi may be complicated by hydro-nephrosis, pyonephrosis, perinephritic abscess or acute pyelo-nephritis. Moreover, the calculus is only unilateral in about 50% of all cases. In some of the cases in which the other kidney is free from stone, it is found to be sclerosed or atrophic. He therefore arrives at the conclusion that renal calculi should be removed as soon as they are diagnosed, except they be very small. If the patient's condition is bad and the stone is causing no symptoms, it may be left untouched. The patient may live for many years with a stone in the kidney. Anuria from calculus is due to one of three conditions. The opposite kidney may be absent or so atrophied as to be functionally absent. It may be blocked by an impacted calculus. Lastly, the second kidney may be temporarily out of court, as a result of a reflex action. As a rule this kidney is diseased and is highly vulnerable. The diagnosis of renal calculus depends on the proper evaluation of signs and symptoms. Pain and hæmaturia are the most important symptoms and of these pain is the more important. It is either acute, paroxysmal pain or a dull, aching pain. It may radiate in many directions. It may be fixed. It is usually increased on jolting or muscular exercise. Some patients obtain relief from the pain only when lying on their back; others can lie on one or other side with comfort. The examination of the urine is of the utmost importance in the diagnosis. X-ray examination should be made in every case and should include both kidneys, both ureters and the bladder. Lett attaches much importance to the treatment after the removal of the stone. The patient should drink considerable quantities of distilled water, such as Salutaris. Hard water should be avoided. If there is oxaluria and phosphaturia, acid sodium phosphate is useful. Alcohol, cheese, milk and sugar should be avoided. The bowels should be regulated.

(104) Retention of Urine.

F. Kreissl and W. H. Gehl (*Urolog. and Cutan. Review*, July, 1920) distinguish between the various forms of retention of urine. In the first place they speak of a "medical" retention, by which they mean retention caused by a toxin or by some paretic condition. It is rarely complete. The patient is usually unable to void urine on account of inability to perceive the distension of the bladder. Often there is the frequent passage of small amounts and much straining. Sometimes this form is encountered in hysterical conditions. The second form is that caused by spasm due to congestion and inflammation. The sphincter passes into a condition of spasm in the presence of infections of the urethra and rectum. Abscess of Cowper's glands, of the prostate and of the vesicles may also give rise to this form, A thorough examination will reveal the nature of the retention in these cases. Vesical calculus or tumour does not produce spasm, except when micturition is attempted in the standing or sitting position. The third form is called traumatic. This form is extremely grave. It may be due to a hæmatoma of the *corpus cavernosum*. Rupture of the urethra is frequently associated with partial or complete retention. Traumatic retention due to strong caustics applied to the neck of the bladder, to prolonged labour and especially to instrumental delivery, to laparatomy or to operations in the vagina or rectum is not a serious condition. The fourth and last group is called mechanical. In this group the authors include compression, as from an abscess of Cowper's glands, an enlarged prostate, a tumour of the *corpus spongiosum* or a dislocated bone of the pelvis. Ill-fitting pessaries and even herniæ are sometimes at fault. In addition this group includes retention due to obstruction. Foreign bodies may be found within the urethra. Vesical or renal calculi are, as a rule, easy to recognize as the cause. The authors regard stricture and prostatic enlargement as obstructive causes of retention of urine. They advocate the aseptic and cautious use of the catheter in the diagnosis of these conditions. Although objection is often raised to catheterization for this purpose. they instance the advantages of its employment in differentiating between the conditions which might give rise to the symptoms complained of.

(105) The Seminal Vesicles and Vasa Differentia.

Hugh H. Young and Charles A. Waters have carried out some studies of the seminal vesicles and *vasa deferentia* after urethroscopic injection of the ejaculatory ducts with thorium (*Johns Hopkins Hosp. Bulletin*, January, 1920). Only during the past few years has attention been paid to the rôle of the seminal vesicles in the production of the numerous types of arthritis, cardiac and gastro-intestinal disturbances and neuroses; up to the present time the assistance to be derived from X-rays has been practically disregarded. By means of a Geraghty's utride syringe the authors found it easy to inject 1 or 2 c.cm. of thorium solution and, by means of the Young urological table, to take excellent stereoscopic X-ray plates of the *vasa deferentia* as far as the external rings. The process is apparently without danger. The authors have a record of some 50 cases without an epididymitis or any other deleterious sequela. They show a series of skiagrams of the vesicles prepared from autopsy specimens to demonstrate variations existing in the anatomical structures. Among the conditions for which this method seems likely to be helpful for diagnosis and treatment, the authors mention the following: (*i.*) To determine the patency of the ejaculatory duct or vas in cases of sterility. (*ii.*) To determine whether stricture of the ejaculatory duct, of the vas, or of the outlet of the seminal vesicles is present. (*iii.*) To disclose the condition of the *ampullæ* of the *vasa* or seminal vesicles in inflammatory or tuberculous conditions. (*iv.*) To show the condition of the seminal tract in studies to determine the cause of vague pain in the region of the prostate, vesicles or bladder. Other uses of this method may be devised at a later date.

(106) Traumatic Stricture in Children.

A. Ralph Thompson discusses the clinical manifestations and prognosis of traumatic stricture of the urethra in children and young adults and calls attention to the urgent necessity of excision of the strictured mucosa in every case (*Brit. Journ. Dis. of Children*, April-June, 1920). He gives accounts of cases to illustrate the form of accident which leads to the formation of stricture. Incidentally he urges surgeons to deal with rupture of the urethra in children immediately by performing supra-pubic cystotomy and plastic repair of the urethra. The rupture may be partial and in this case it may be either of the under or of the upper surface. It may be necessary to use considerable skill to direct the catheter along the ruptured tube. Often this is impossible. The urologist usually sees patients with traumatic stricture long after the primary rupture has taken place. The peri-urethral and extra-urethral tissues are replaced by dense fibrous tissues. Since the bladder in young subjects is capable of hypertrophying to a considerable extent, the stricture is often extensive before the symptoms become urgent. In many cases the ends of the ruptured urethra are not in line with each other. The treatment in these cases is first of all by catheterization. If this fails, excision is necessary. It is of importance to preserve the urethral structure and to move as much of the fibrous tissue as possible. After the repair has been effected, the urethra should be buried as deeply in the surrounding structures as possible.

Australasian Medical Congress, Brisbane, 1920.

THE SECTIONS—*Continued.*

SECTION OF NEUROLOGY AND PSYCHOLOGICAL MEDICINE.

The President, Sir Henry Maudsley, K.C.M.G., read an address on the modern aspects of the physiology of the central nervous system.

Psycho-Therapy.

In his absence a paper by Dr. J. W. Springthorpe (Melbourne) on psychology in medicine was read. The author pleaded for adequate study of psychology in the medical curriculum. He adduced evidence in support of his contentions that the student learned nothing concerning the mind and its influence over the body and that this chapter of medicine was of great importance. He asked Congress to endorse the proposals that psychology should be included in the curriculum, that there should be a psychological department in all teaching hospitals and that the attention of the medical profession should be drawn to the need for the study of psychology and the practice of psycho-therapeutics.

Dr. George E. Rennie (Sydney) read a paper on psycho-analysis in the treatment of mental or moral deficiency. He stated that, while he had long recognized the value of psycho-therapy, he had been prejudiced against the doctrine of the psycho-analysts on account of the arbitrary manner in which dream complexes were interpreted and on account of the unjustifiable reference of almost everything to sexual impulses. He pointed out that Freud in his more recent writings revealed a tendency to modify his extreme views, but this attitude had not been adopted by his followers. Dr. Rennie then proceeded to give a full account of a case of a morally defective boy whose actions and delinquencies had been studied by a lay psycho-analyst. Close attention to this case had compelled him to modify his views in regard to the possibility of the real basis of disturbances due to suppressed sexuality. He admitted that psycho-analysis represented a great advance in the treatment of mental disorder and that the methods should be given an extensive trial.

Dr. W. Ernest Jones (Melbourne) read a paper on the necessity for the establishment of psychiatric clinics. He pointed out that Congress had considered this subject in 1911 and had resolved that the treatment of mental disorders in their early stages should be undertaken in specially equipped wards in general hospitals and that specially trained assistants should be appointed for this work. A sub-committee of the Medico-Psychological Association of Great Britain and Ireland had also considered this subject. This committee had arrived at the conclusion that the absence of facilities for efficient early treatment had resulted in lost opportunities to alleviate and to cure mental disturbances. The sub-committee recommended the establishment of psychiatric clinics by local authorities. These clinics should be subject to inspection and control by a central Government department. Dr. Ernest Jones gave an account of the existing institutions in various parts of the world. In England important neurological and psychiatric work was carried out at the Maudsley Hospital, which had been established during the war. He recognized the excellent services which had been rendered by S. W. Mott in this connexion. The psychiatric clinic had existed in Germany for many years. In America and Canada the psychiatric clinics were attached to the general hospitals, but were under the control of the Lunacy Department.

The speaker demanded that the subjects of psychology and psychiatry should receive more adequate treatment in the medical curriculum. The psychiatric clinic attached to the teaching hospitals would render it possible for the student to equip himself in these branches of medical science.

War Neuroses.

Several papers dealing with various aspects of the subject of war neuroses were mentioned on the sectional programme. The first was by Dr. S. F. McDonald (Brisbane) on the neurotic basis of "D.A.H."

Dr. R. C. Withington (Melbourne) dealt with the treatment of neuroses by suggestion and hypnotism. After he had given a short account of the significance of suggestion, he pointed out that it was due to Liébault, Wetterstrand, Lloyd Tuckey and others that psycho-therapeutics had been saved from the hands of charlatans. Suggestion frequently sufficed, but since hypnotism increased suggestibility, the latter should be employed if necessary. He had used both in the treatment of psycho-neuroses in soldiers with great success. At times the suggestion was assisted by medicinal treatment. In every case regular habits were inculcated. Dr. Withington had found that 95% of soldiers could be hypnotized. The percentage among the civil community was lower. The results were often startling. He desired to call attention to this method of treatment.

Dr. C. C. Godfrey (Melbourne) spoke of his experience of about 400 cases of war neuroses in soldiers under treatment at the No. 5 Australian General Hospital. The term "shell shock" had been discarded. The majority of the patients exhibited conditions of nervousness, hyperæsthesia to light or noises, insomnia, night terrors, a feeling of falling through space when asleep, impaired memory, etc.. These men were suffering from emotional traumata and the term anxiety hysteria appeared to be appropriate. At times the psychical elements were associated with physical symptoms, such as tachycardia, tremors, stammering, aphonia, functional paralyses, paræsthesia and anæsthesia, blindness, deafness or viscerable disorders. In addition to the psychical trauma, there was often a physical trauma. Dr. Godfrey reminded his audience of the psychogenic mechanism in these cases, the repression from consciousness of memories of unpleasant or agitating experiences and the subsequent re-awakening into activity of the buried complex and its conflict with the conscious state. The only rational treatment of such conditions was by psychic methods, although it should be recognized that physical defects required appropriate treatment. He examined the differences of opinion between the various schools of psycho-therapeutists. The most frequently used methods were persuasion, waking suggestion, hypnotic suggestion and psycho-analysis. Each method, if skilfully applied, was of great value in individual cases. He spoke of the excellent results gained in patients by these means.

Dr. A. E. Rowden White (Melbourne) gave an account of the method adopted at the Ashhurst Hospital, Littlemore, Oxford. Each medical officer had his own special way of dealing with patients, but would adopt any plan shown by his colleagues to be of use. In the majority of cases there was amnesia concerning the period immediately connected with the paralysis or other complaint. The subconscious mind was worrying over the shock which originally produced the trouble. The neuroses were due to the constant repression of these unpleasant thoughts. The analysis was carried out either while the patient was awake (psycho-analysis) or during induced sleep (hypno-analysis). The co-operation of the patient was essential. He had to be assured that there was nothing to fear. He had to disclose all his fears, worries, etc.. Dr. White pointed out that it was necessary to apply these methods on scientific lines. Much harm was done by allowing charlatans to persuade the public that they alone could carry out this treatment.

Dr. T. Garnet Leary (Melbourne) dealt with the subject of stammering as a war neurosis. He applied his method of overcoming the defect of stammering after he had ascertained whether there were any hidden complexes which might account for the anxiety state. Stammering would not yield to psychic methods alone. Systematic drill and rhythmic vocal exercises were necessary. He demonstrated his method. In reply to a question, Dr. Leary stated that as a rule patients who had learned to speak without the aid of the metronome, could do so even before a strange audience, although there was a tendency for the neurotic element to give rise to a relapse in these circumstances.

Dr. Ralph A. Noble (Sydney) gave a detailed account of the methods employed in the various hospitals and other institutions in the No. 2 Military District. Patients suffering from mental diseases were separated from those affected

with war neuroses. In Broughton Hall and the No. 28 Australian Auxiliary Hospital they had been able to elaborate the systems of treatment. The Red Cross Society had established a chain of hospitals in the State of New South Wales and was responsible for the greater part of the equipment, etc.. Returned men suffering from alcoholism were segregated. Details were given concerning the classification of cases and the avoidance of disturbing elements either in the form of unsuitable patients or in the way of unconscious contra-suggestion on the part of nurses and others. The harmful effect of family and outside interference was removed by the strict limitation of leave. The sisters and nurses were specially trained by the medical officer responsible for the institution. Dr. Noble gave a full account of the extent to which psycho-analysis, suggestion, hypnotism, physical treatment, etc., were employed. He also dealt with the value of the co-operation of a social service and the importance of re-education and relaxation in the scheme.

A paper by Dr. J. W. Springthorpe (Melbourne) was read. In this paper the author, who was not present at the Congress, gave an account of the institutions in England and France during the war for the treatment of war neuroses. He also included a description of the methods of treatment employed both in England and in Australia.

Papillœdema.

Professor A. E. Mills (Sydney) opened the discussion on papillœdema by defining the condition as an œdematous swelling of the papilla. It was the index of a very serious set of conditions, was very common and was often neither suspected nor looked for. In the main, it was part of a general intracranial œdema or increased intracranial tension. Professor Mills dealt with the mechanism of the production of increased intracranial tension. The skull, save in infants, was an incompressible box containing the brain and its membranes, the blood vessels and cerebro-spinal fluid. There were no true lymphatics in the brain. Alterations could only be brought about by variation of the fluid contents of the cranium. It could be induced voluntarily, as in straining. The normal amount of cerebro-spinal fluid was so small that any displacement of this fluid from the cranium into the spinal theca would not affect the tension. In the next place he discussed the choroid plexus, which was in effect a gland. It depended for its activity on a proper blood supply. In certain conditions there was an increase of secretion of cerebral-spinal fluid and its accumulation. The pressure of the cerebro-spinal fluid could not exceed that of the arterial blood. The pressure might be sufficient to impede the venous circulation in the cranium. The increased carbon dioxide tension resulting would thus stimulate the vasomotor centres and give rise to an increase in the blood pressure. In the next place Professor Mills explained that cerebral tumours usually grew at the expense of the brain tissue. The destruction of brain tissue and the diminished blood supply resulted in the liberation of "extract of brain substance," which, like carbon dioxide, was a stimulant for the secretion of cerebro-spinal fluid. This extract of brain substance appeared to exert the action of a hormone. It could be detected in the cerebro-spinal fluid in general paralysis of the insane and in softening of the brain. In rapidly growing tumours there would be a considerable amount of this extract liberated and consequently the intracranial tension would be increased. Slow growing tumours behaved differently. There would be less destruction of brain matter. In the majority of cases he held that the size of the tumour was of small moment. He adduced evidence in favour of the hypothesis that certain infective processes or chemical agents stimulated the choroid gland and thus led to increased intracranial tension. In those cases in which papillœdema was present without any increased quantity of cerebro-spinal fluid, he assumed that the increased tension was due to the tumour itself.

Dealing with the question of treatment, Professor Mills referred to the endeavour to combat the causes of focal infection, renal disease, lead poisoning, etc.. He also pointed out that papillœdema was not an early sign of cerebral tumour. Cushing had operated on three such tumours before papillœdema had developed. Even when the diagnosis had not been made at an early stage, the tumour should be dealt with surgically. He suggested that it might be advisable to expose the optic nerve and to open the sheath for the purpose of relieving the increased intracranial tension by draining off some of the cerebral fluid.

Sir James Barrett, K.B.E., C.B., C.M.G. (Melbourne), congratulated Professor Mills on the very clear exposition of a most important subject. The condition of papillœdema was often unsuspected. He had known patients who had gone about in apparently good health until the condition was well advanced and there was a marked degree of optic swelling. It was the diminution of vision which in many cases brought the patient to the doctor. He asked Professor Mills whether he distinguished between changes due to inflammation and those due to pressure. He emphasized the importance of frequent examination of the fundus. Marked changes might occur within a few days. He said that Dr. Lockhart Gibson had shown them many patients who had recovered from papillœdema with good vision, some after 8 or 9 years. These patients were presumably suffering from plumbism.

Sir Henry Maudsley, K.C.M.G. (Melbourne), referred to the history of a patient who had been under the care of Sir William Gowers for a number of years. Papillœdema was present and the case was regarded by Sir William as one of intracranial tumour. It had seemed to the speaker and to other students of that time that the diagnosis was incorrect. The patient had eventually been admitted into hospital in convulsions and had died. At the autopsy an intracranial tumour had been found. Sir Henry Maudsley also quoted a case of a patient who presented signs of optic atrophy and who recovered completely under antispecific treatment. In some cases thrombosis occurring during anæmia, was the cause of the swelling of the optic discs. Patients suffering from this condition usually got well. Regarding the question of operations for the relief of increased intracranial pressure, he spoke of the work of Victor Horsley.

Dr. J. Lockhart Gibson (Brisbane) said that papillœdema, as distinguished from albuminuric (neuro-) retinitis, was caused by increased intracranial tension. Increased intracranial tension was produced either by an intracranial new growth or by some toxic substance circulating in the blood. He referred to the subject of plumbic papillœdema occurring among young children in Queensland. In some cases as much as eight diopters of swelling had been noted in the disc. The vision was restored after appropriate treatment. Usually there remained partial post-papillœdemic atrophy of the disc and the remains of a star figure near the macula.

He also related the case of a women with papillœdema of six diopters in each disc, due to a cerebral gumma. Under treatment the vision had recovered. When the cause of the papillœdema was a removable one, as in plumbism or cerebral gumma, a decompression operation should not be undertaken.

Dr. H. Lindo Ferguson (Dunedin) found satisfaction in the fact that physicians realized the importance of sending patients with progressive swelling of their optic disc to the surgeon, in order that the increased intracranial tension might be effectually relieved by a decompression operation and the sight saved.

Dr. W. W. Hoare (Brisbane) wished to know why papillœdema occurring in children in Queensland should so frequently be ascribed to lead.

Dr. Sinclair Gillies (Sydney) spoke of the risks of lumbar puncture in cases of intracranial tumour.

Dr. R. R. Stawell (Melbourne) congratulated Professor Mills on his excellent paper. He showed by means of a diagrammatic drawing why it was that in some cases of intracranial tumour no swelling of the optic disc occurred. It was due to the blocking by the tumour of the communication of cerebro-spinal fluid in the sub-arachnoid space with that of the vaginal sheath. He emphasized the risk of lumbar puncture in cases of intracranial tumour. Flexner had shown that injury to the meninges and choroid brought about by the puncture might be sufficient to determine the site of a cerebro-spinal infection. Dr. Webster had carried out investigations at the Children's Hospital in Melbourne

and had shown that there was a definite risk associated with lumbar puncture in certain cases.

In his reply, Professor Mills said that he hoped that he had not been misunderstood. He was well aware that certain retinal changes were due to inflammatory processes. His contention was that papilloedema was in the main part and parcel of a general intracranial œdema, resulting from increased intracranial tension. He admitted the risk associated with lumbar puncture. It was, however, the only available treatment when the patient was in a comatose condition.

The Physical Basis of Insanity.

Dr. W. A. T. Lind (Kew, Victoria) dealt with the physical as contrasted with the psychical basis of insanity. He explained that psychiatrists were divided into two schools, those who claimed that mental disturbances were caused by the influence of some forgotten experience of an unpleasant nature and those who sought some anatomical change for a disturbance manifested by mental symptoms. After fourteen years of study and eight years of investigation into the morbid anatomy of various insanities, he had arrived at the conclusion that the physical explanation was the correct one. Dr. Lind entered into a general discussion of the attitude adopted by psycho-analysts. He distinguished sharply between the psycho-neuroses and true insanity, which was not a functional condition.

SECTION OF NAVAL AND MILITARY MEDICINE AND SURGERY.

Physical Standards for Recruits.

The proceedings of the Section opened with a paper by Lieutenant-Colonel Sir James Barrett, K.B.E., C.B., on "The Necessity of Determining the Physical Standards Requisite for Recruits." His remarks were based on experience gained by him in Egypt during the last two years of the war, when acting as president of a standing medical board. At that time it had become increasingly difficult to reinforce the Egyptian Expeditionary Force. In fact, the authorities were advised early in 1917 that no more "A" class reinforcements were to be expected from Great Britain. Under these circumstances it became necessary to review the case of every man who had been classified as other than "A" class. Of these there were many thousands employed in garrison battalions, line of communication units and depôts, in the Army Service Corps, Ordnance Corps, Royal Army Medical Corps, etc.. To meet the needs of the situation the medical boards in Egypt, with the aid of the consultant medical officers of the Egyptian Expeditionary Force, adopted certain standards of fitness for the several branches of the service. These standards were officially approved and promulgated to all medical officers in a printed memorandum.

Some 50,000 men were reclassified under the modified standards, with a resultant gain to the fighting force of many thousands, who did excellent work in the firing line. Interesting examples were quoted by Sir James of the result of this "combing out" (*i.*) a garrison battalion of 779 men, of whom 393 were found to be "A" class, (*ii.*) a newly-arrived draft of 50 men, of whom 22 were raised by the Board from "B" to "A" class. These had been disqualified, 15% on visual standards alone; others for defective teeth and otorrhœa. By the application of suitable treatment and classification, all these men were utilized to the best advantage. Sir James suggested that, had these less rigorous standards been in vogue in Great Britain, the British Army would have been so much strengthened that the defeat of the Fifth Army in March, 1918, would probably have been averted. In the light of his experience, he urged that Congress should suggest to the Commonwealth authorities:

> (*i.*) That a complete investigation of the physical standards necessary for recruits in the Australian Army be undertaken; (*ii.*) that the information conveyed by these standards be made available on all occasions; (*iii.*) that the work of enrolling men for war service be undertaken by whole-time medical officers withdrawn from practice; (*iv.*) that these medical officers be selected in peace time from area medical officers possessing military experience.

In the discussion, Lieutenant-Colonel H. N. Butler, D.S.O. (Hobart), seconded Sir James Barrett's proposal and emphasized the need for laying down proper standards for compulsory trainees. Colonel A. Graham Butler, D.S.O., spoke strongly in favour of the motion, but wished to see the medical profession much more keenly interested in the matter. He endorsed the suggestion that the area medical officer with military experience should be selected as the recruiting medical officer.

Surgeon-Captain E. T. P. Eames, Director of Naval Medical Services, said the standard for a long service enlistment—twelve years in the Australian Navy—must necessarily be more rigorous than for temporary service in a national emergency. As he put it, the spear head must be kept bright and he would not support any lowering of standard for the "permanent" sailor.

Lieutenant-Colonel W. L'Estrange Eames, C.B., C.B.E., V.D., Principal Medical Officer of the No. 2 Military District, pointed out that the official standard in Australia had been laid down as suitable for the permanent force man. He agreed that there should be modifications of this standard to meet requirements of other branches of the service.

Colonel J. L. Beeston, C.M.G., and Lieutenant-Colonel L. W. Bickle also spoke and Sir James Barrett briefly replied.

Lieutenant-Colonel J. S, Purdy, D.S.O., read a paper on "Sanitary Organization in War." He outlined the organization as laid down and suggested that more attention should be given to hygienic instruction of cadets and other trainees and further development of the teaching of hygiene at medical schools.

Military Orthopædics.

Dr. A. V. Meehan (Brisbane) presented a number of patients suffering from orthopædic affections, who had been under his care at Rosemount:

(*i.*) Loose cartilage of the knee joint, which had been removed under local anæsthesia.

(*ii.*) Ulnar-median nerve suture.

(*iii.*) Tendon transplantation of *tibialis anticus* for destruction of peronei.

(*iv.*) Transplantation of flexor tendons for extension of wrist and hand.

(*v.*) Bone graft of radius.

(*vi.*) A case of amputation of the leg, with ankylosis of the knee, fitted at Rosemount with a specially designed tuber-bearing artificial limb.

Some of these patients were subsequently shown to the meeting of the Section of Surgery in connexion with papers by Dr. Lennox G. Teece (Sydney) and Dr. N. S. Royle (Sydney). A discussion followed, in which Colonel R. J. Millard, C.M.G., C.B.E., Dr. N. D. Royle and Dr. L. G. Teece took part.

Military Hygiene.

Dr. M. J. Holmes (Darwin) read a paper on the application to civil life of lesions of military hygiene derived from the great war. The remarkable reduction in loss of life from disease during the recent war, as compared with all previous wars, had been one of its most prominent features. Despite the fact that the problems of disease prevention and control were much greater in the Army, with its constant movement and activity, than in a stationary civil community, a preventible disease made less headway than in a civil population of the same size. This result was due far less to discipline than to the practical appreciation and interest displayed by what amounted to an educated community in measures of health protection. The channel of administration in preventive medicine from general head quarters to the medical officer in the field was direct and simple. Full and sole responsibility for measures required under any given set of conditions rested always upon one man and one alone. Research held a position of the very highest importance in the preventive organization. The entire army was educated in the principles of prevention of disease. It was practical to give effect to a similar organization among civil communities and to achieve even better results. One of the essentials required was an extension of the education of the medical profession, such as was carried out in the army. Means by which the community could be educated were numerous and could be utilized to the full. The inevitable result would be not only intelligent co-operation, but a spirit of self-reliance and initiative. By educa-

tion the public health sense of the community could be so raised that the investigation, prevention and control of all disease would be greatly simplified and facilitated. The real principles which underlay the success of military public health administration, could be readily adapted to civil life. Dr. Holmes concluded by outlining the details by which this concept could be put into operation.

Dr. J. S. Purdy, D.S.O. (Sydney), referred to the fact that the first sentence of the standard work, "The R.A.M.C. Training," was that the Army Medical Corps existed, firstly, for the prevention of disease and, secondly, for the treatment and care of the wounded. He advocated the teaching of hygiene and sanitation for military men, by the establishment of chairs of preventive medicine in the universities with medical schools and the formation of medical officers' training corps in medical schools. It was necessary for every man in the army to have some training in hygiene and sanitation and to obtain this hygiene should be taught in all schools from the kindergarten stage to the final year.

Colonel A. G. Butler, D.S.O. (Brisbane), pointed out that the principles of the army system could be applied, but not the details, as they could not enforce discipline. They might cause opposition. He suggested that the conclusions of Dr. Holmes be sent as a special resolution to Congress.

Dr. Harvey Sutton, O.B.E. (Sydney), said that the supreme difference between civil and military work was not, as was commonly thought, the question of compulsory powers and discipline. The most important question in the field was man-power. The closest attention to this was the duty of the Commander-in-Chief and every commanding officer. This interest in humanity was not the chief interest of governments, for thoughts of fiscal tariff, commercial and other problems formed the chief plank of every political platform. Compulsion was very rarely useful, though the power should be provided. Health control must be educated and helpful to be effective and the Australian reacted most favourably to the appeal to reason and when convinced, he was a most willing helper. Education must be the keystone of the system based on thorough research. If they followed out the wise lines laid down in Dr. Cumpston's address and Dr. Holmes's paper, the medical practitioner would form the rank and file of health control. During his five years at the university the medical student was in the citizen army and passed through various non-commissioned offices, to emerge with a commission on qualifying. Here was a splendid opportunity to carry out practical work in sanitation and health control generally. It would readily be made more extensive and co-ordinated the lecture and laboratory training in the regular university course in hygiene and public health. Finally, the essential health control must utilize to the full the human personal factor. Administrative central control by a few experts for millions of inhabitants was a failure. Government should be urged to put into practice these principles so eminently successful in military life and to make the interest in humanity the first plank in every platform.

Malaria.

Dr. N. Hamilton Fairley, O.B.E. (Melbourne), read a paper on "Observations on the Clinical and Applied Pathology of Malaria."

Dr. R. H. Cummins (Brisbane) asked for information with regard to the relationship of malaria with regard to life insurance and also the treatment of filariasis.

Dr. E. W. Ferguson (Sydney) emphasized the frequency of double infections and the fact that in recurrences the organism found was usually the benign tertian. With malignant tertian infections it was usually "kill or cure." With efficient early treatment with quinine, cure was almost certain. As regards death from cerebral malaria, *post mortem* examination showed death to be due sometimes to plugging of capillaries, sometimes to a toxin.

Dr. F. Guy Griffiths (Sydney) said that his experiences had been similar to Dr. Fairley's, but he considered with Osler that the best time for taking a blood film was during the afebrile stage.

Dr. A. H. Tebbutt, D.S.O. (Sydney), asked whether Dr. Fairley had considered that the erythroblastic reaction of the bone marrow was compensatory or due to a toxin.

Dr. R. H. Fetherston (Melbourne) had treated a large number of returned sisters for malaria. He described his method of treatment. He gave preliminary rest and salines to get rid of toxins. He then gave 0.6 grm. of quinine a day with iron sesquioxide. He insisted on hospital treatment for one month; the quinine was taken for eight weeks. The results were good.

Dr. C. Bickerton Blackburn, O.B.E. (Sydney), discussed the clinical aspect of the disease. A common symptom in chronic malaria was pain in the shins due to infection of the bone marrow. An extraordinary resemblance to pernicious anæmia was noted in the aspect of the case. Many cases of so-called chronic malaria improved with rest and without specific treatment. If they were satisfied that the patient had malaria, the rule was to give quinine and to give it hard, up to 2.7 grm. a day for three or four weeks. Quinine should not be pushed when there were complications, such as broncho-pneumonia. Many patients resisted all endeavours to treat by quinine given by the mouth, even in solutions, but improved rapidly and remained free from recurrence when the quinine was given intravenously. He considered the intravenous far preferable to the intramuscular method. With reference to life insurance, he considered that, after twelve months' freedom from any symptoms, the risk might be considered first-class. His experience was that the best time for taking blood film was during the pyrexial period.

Corrigendum.

In our report of the proceedings of the Section of Pathology and Bacteriology, published in last week's issue (page 274), the first paper on the complement fixation tests was erroneously ascribed to Dr. A. H. Tebbutt. The author was Dr. C. J. Wiley.

Obituary.

LAURENCE HERSCHEL LEVI HARRIS.

When Herschel Harris was laid in his grave at Rookwood Cemetery, near Sydney, on September 15, 1920, not only those who attended the funeral—a military one—but all medical men, very many nurses and hosts of friends grieved for him and sorrowed that so useful a life should be cut off so prematurely. During the last few years the death of so many brilliant men, of every age, calling and profession, has been such a commonplace daily occurrence that the world in general has to a great extent lost the capacity for being shocked at the untimely cutting short of careers, either just beginning or at their zenith. But Herschel Harris's death was peculiarly sad, for he had endured the hardships and survived the dangers of two years' warfare to return home and die not two years after peace had been declared.

Laurence Herschel Harris was born on December 8, 1871. He died at his home in Macquarie Street, Sydney, on September 13, 1920, after a most distressing illness lasting 15 weeks. The cause of death was encephalitis following influenza. During this long illness he suffered much pain and discomfort and there must also have been great mental suffering and uneasiness, because, being a medical man, he must have known quite early in the illness that the outlook was most grave and that, even if he survived, it would only be as a disabled man.

He was educated at the Sydney Grammar School and afterwards at the Sydney University, where he took his first year in Arts in 1890. After that he went through the medical course from 1891 to 1896, when he graduated. After graduation he became one of the resident medical officers at the Sydney Hospital, later on becoming senior resident medical officer and later still acting medical superintendent. He was always a keen photographer, both as a school boy and as a student; his interest in this hobby naturally led him on to X-ray work, which was just at this time being introduced all over the world.

He was thus one of the pioneers of this most important adjunct to surgery and medicine. At the time of his death he was the last living pioneer in harness in Australia.

Nearly all men who began this work in the early days, suffered through ignorance. They did not protect them-

selves from the rays and subsequently paid the penalty by acquiring a dermatitis. Harris was no exception and he was troubled for many years with his hands.

In 1900 he was appointed Honorary Radiographer to the Sydney Hospital, which post he held for 15 years, when he was made Honorary Consulting Radiographer. In 1902 he became Assistant Surgeon to the same hospital, but after a few years he resigned this position, finding that he must devote the whole of his time to his special line of work. As a radiographer he held very many appointments and wrote numerous papers. At the time of his death he was Honorary Radiographer to the Royal Prince Alfred Hospital, the Royal Alexandra Hospital for Children, to the Tubercular Dispensary and the Australian Jockey Club Home at Canonbury.

In 1914 he was away on holiday in England and was present at the annual meeting of the British Medical Association held in that year in Aberdeen. At the Congress Ball on July 28, hearing that a number of medical officers were called up and that war with Germany was imminent, he volunteered his services to Colonel W. L'Estrange Eames as radiologist for any Australian unit that might be organized for service.

On August 16, 1914, when Colonel Eames received instructions from the Director-General Medical Services of the War Office to organize and to command the Australian Voluntary Hospital, Dr. Herschel Harris was offered the post of radiologist with the rank of Captain in the Royal Army Medical Corps (temporary). He accepted and organized his department so efficiently that on arrival at St. Nazaire on September 5, 1914, seven hours after the equipment was landed at the hospital, X-rays were available for the use of wounded who were arriving from Mons.

Colonel Eames has stated that this was the first X-ray apparatus that was in working order in the British Expeditionary Force. He adds that Herschel Harris's work as a radiologist was of the highest order. As an officer and comrade he will long be remembered by his brother officers.

In the spring of 1915 Herschel Harris, who had been promoted to the rank of Major, was ordered by the Commonwealth Government to join up with No. 3 Australian General Hospital at Lemnos. The outfit and apparatus which after careful personal selection he took out with him and established there under great difficulties, was subsequently pronounced by the late Sir Victor Horsley to be the best equipped X-ray outfit in the Mediterranean Expeditionary Force. There, under great disadvantages of climate and surroundings, hampered by continual ill health, he manfully stayed and did his duty until just about the time of the evacuation of Gallipoli, when he was invalided to England on account of his hands.

He was a man of most kindly and generous disposition, always ready to share his knowledge and experience with others, even though they might become his rivals. He was liked and trusted to an unparalleled degree by his fellow medical men, who were always ready to take his advice as to how and where any relative of theirs should be treated.

All through his life he has been noted for his goodness to nurses. In his will he has left "to the Treasurers for the time being of the Royal Prince Alfred and Sydney Hospitals the sum of £4,000 to be held by them upon trust to apply the income in equal proportions, so far as may be considered necessary, in each year in rendering pecuniary assistance to nurses employed at these hospitals who, either during their course of training or while on the staff, shall be rendered temporarily incapable through illness or accident from continuing to discharge their duties, with a view to afford such nurses an opportunity for a change of air and scene and thereby assist them in regaining health."

His kindness to and thoughtfulness for the nursing staff at Wimereux and on Lemnos will long be remembered. All his military pay in the early months of the war was devoted to providing them with extra and much needed comforts. At Lemnos he used to spend his time off duty in visiting the little farm houses in order to purchase eggs, etc., for them. Through him, too, the whole camp was provided with electric light and there are innumerable tales of his generosity to both staff and patients, with whom he was a general favourite.

After leaving hospital in England he returned to Australia *viâ* America, where he was made a life member of the American Röntgen Society. While there he spent a good deal of money in obtaining all the latest and most up-to-date X-ray apparatus, with which he was working up to the time of his illness.

The numerous war photographs he had taken in France and Gallipoli, he had converted into lantern slides and presented them to the Cavell Memorial Home, after exhibiting them and lecturing on them in aid of the fund.

What has been written is sufficient evidence of his character and disposition. His was a most gentle nature, always thoughtful for others and generous to a fault. It is hardly necessary to add that his position here as an expert radiographer was unchallenged. He was the acknowledged head of this branch of the profession; the majority of the men doing this work in Australia now were formerly his pupils and owe much to him.

THE SOCIETY OF RETURNED MEDICAL OFFICERS OF NEW SOUTH WALES.

The Annual Dinner and General Meeting of the Society of Returned Medical Officers of New South Wales will be held on Thursday, October 7, 1920, at 7 p.m., at the Burlington Café, George Street, Sydney.

The Honorary Secretaries will be glad if members of the Society and all other returned medical officers who intend to be present, will apply without delay for tickets

(20s. each inclusive) so as to facilitate arrangements for the catering.

Directory.—It has been decided to compile and issue to members a directory of all medical officers who have been on service and are now practising or resident in New South Wales. The Honorary Secretaries wish any medical officers who have not yet done so, to send in their addresses at an early date, stating their rank, last unit, etc..

Subscriptions—Subscriptions are now due. Intending members are reminded that in addition to the annual subscription (5s.) there is an entrance fee of 5s..

CHARLES E. WASSELL, Hunter's Hill.
HUGH R. G. POATE, 225 Macquarie Street, Sydney.
} Joint Honorary Secretaries.

Correspondence.

ANÆSTHETICS ADMINISTERED BY DENTISTS.

Sir: In your issue of September 11 is a letter from a dentist, Dr. W. S. Ziele, in which the following statement is made: "It is a most significant fact that no death has ever occurred in New South Wales in the use by dentists of ethyl chloride."

Dr. Ziele is, I doubt not, writing in ignorance, but that does not excuse him from the charge of disrespect to your readers in presenting careless and unverified statements in argument. He is writing controversially and builds argument on a statement put forward, by his authority, as a fact, which is not a fact.

It will be within the recollection of many of your readers and of many dentists that a dentist practising in Oxford Street, Sydney, had a death during administration of ethyl chloride by him. The date could, no doubt, be easily found from the Coroner's records. I remember the scare it caused.

Yours, etc.,
C. E. CORLETTE.

175 Macquarie Street, Sydney,
Sydney 11, 1920.

THE TITLE "DOCTOR."

Sir: When I came out to West Australia a few years ago I was very surprised to find that every medical practitioner styled himself "doctor" irrespective of his qualifications or practice.

Even the few (one or two at most) who practised nothing but surgery, had on their plates "Dr." I still think this is a great pity, and when I spoke to a surgeon about it he said: "It is the custom here." No doubt following the track of our cousins across the water.

In the *West Australian* of August 27 last, I read with pleasure that at the Medical Congress, Dr. Hamilton Russell (Melbourne) moved that an Australian association of surgeons be founded, and that a college of surgeons be formed as suggested by Professor L. Barrett, of Chicago, with power to admit fellows after examination.

On the same lines, may I strongly urge that a college of physicians be also formed, with power to admit members and fellows after examination, thus following the Royal Colleges of Physicians and Surgeons in London, but not necessarily to be a conjoint board. Personally I think they would be better separate, as individual institutions.

Ourselves and the public would then be able to differentiate the physician and the surgeon.

Further, I would suggest that only those members of our profession who hold the M.D. degree should call themselves doctors. Surgeons, I am sure, would welcome the "Mr." I am not suggesting that only M.D.'s should be called doctors, because I myself happened to hold that degree, but purely on the ground of academic equity and logic.

And, for the same reason, an M.B. has no more right to style himself "doctor" than a B.D. or a B.Sc.. Those who wish to be called doctors, let them qualify for the higher degree which academically entitles them to the title.

Now, sir, as Editor of *The Medical Jounrnal of Australia*, may I suggest to you that in future you should describe only those members of our profession who hold the M.D. degree as "doctors," thus following the practice (and the right one) of the *British Medical Journal* and the *Lancet*.

By adopting these methods I am convinced that the prestige of our profession will be raised in the public estimation, which it sadly needs.

Yours, etc.,
MORGAN RICHARDS, M.D..

"Bryn Hyfryd,"
Kalamunda, Western Australia,
September 7, 1920.

[Dr. Richards appears to be unaware of the prolonged discussion that took place in the United Kingdom several years ago in which it was pointed out that the public were confused by the differentiation between "doctor" and "Mr." This discussion culminated on December 21, 1912, by the amendment of a by-law by the Royal College of Physicians of London. This alteration had the effect of allowing diplomates and members to use the title "doctor," although it is expressly provided that they shall not append to their names the title of "doctor of medicine or the letters M.D.." The *British Medical Journal*, discussing this matter (April 26, 1913), points out that "by long use and wont the title of 'doctor' has come to be almost universally applied by the public to all practitioners of the healing act." Later the Royal College of Physicians of Edinburgh and of Ireland adopted the same attitude. Within recent years surgeons in Great Britain and Ireland have elected to use the courtesy title of "Mr." The same practice has been adopted in Melbourne to some extent and by a few in Sydney. The eminent Melbourne surgeon referred to by Dr. Richards, prefers to be called "Mr." Hamilton Russell and is always so designated in this *Journal*. The lay press does not study the desires of members of the medical profession.—ED.]

THE ALCOHOL QUESTION.

On June 18, 1920, it was resolved at a meeting of the Queensland Branch of the British Medical Association that the questions to be decided by the community of Queensland in October be referred to the members of the Branch. The issues to be submitted are as follows:—

(*i.*) Statement of manufacture, importation and sale of fermented and spirituous liquors.
(*ii.*) Prohibition of manufacture and importation and retail of fermented and spirituous liquors, to take effect in 1925.
(*iii.*) Continuance of the present system.

In accordance with this resolution, 280 ballot papers were issued and 158 replies were received. The result is as follows:—

Prohibition	104
Continuance	32
State Control	22

The undermentioned have been elected as members of the Victorian Branch of the British Medical Association:—

Namon L. Cass, Esq., M.B., B.S., 1920 (Univ. Melb), Fitzgibbon Street, Parkville.
E. W. Chenoweth, Esq., M.B., B.S., 1920 (Univ. Melb.), Melbourne Hospital.
Sydney Crawcour, Esq., M.B., B.S., 1918 (Univ. Melb.), Mathoura Road, Toorak.
S. E. Francis, Esq., M.B., B.S., 1920 (Univ. Melb.), 14 Fulton Street, East St. Kilda.
D. C. McSweeney, Esq., M.B., B.S., 1920 (Univ. Melb.), St. Vincent Hospital, Fitzroy.
Bernard H. Quin, Esq., M.B., B.S., 1920 (Univ. Melb.), "Woodcote," High Street, Malvern.
Max Yuille, Esq., M.B., B.S., 1914 (Univ. Melb.), "The Nook," Carlisle Street, St. Kilda.
Charles James Officer Brown, Esq., M.B., B.S. (Univ. Melb.), 1920, Melbourne Hospital.
Lindsay Walker Craig, Esq., M.B., B.S. (Univ. Melb.), 1918, Yarram.
Harold Fleming Dunstan, Esq., M.B., B.S. (Univ. Melb.), 1914, Elsternwick.
Keith Douglas Fairley, Esq., M.B., B.S. (Univ. Melb.), 1920, Melbourne Hospital.

William Arthur Bowman, Esq., M.B., B.S. (Univ. Melb.), 1920, Fitzroy.
Allan Edward Lee, Esq., M.B., B.S. (Univ. Melb.), 1920, Melbourne Hospital.
Henry Newman Mortensen, Esq., M.B., B.S. (Univ. Melb.), 1920, St. Vincent's Hospital.
Isaac Palol Yoffa, Esq., M.B., B.S. (Univ. Melb.), 1920, East Brunswick.

The following have been elected members of the Queensland Branch:—

William Atkinson Harrison, Esq., M.B., Ch.M. (Univ. Edin.), 1880, Department of Public Health, Brisbane.
Aneas John McDonnell, Esq., M.B., Mast. Surg., 1889, M.D., 1896 (Univ. Syd.), Toowoomba.
H. Morrissey, Esq., Ingham, North Queensland.

Medical Appointments.

Dr. A. T. H. Nisbet (B.M.A.) has been appointed Honorary Radiographer to the Hospital for Sick Children and to the Mater Misericordiæ Hospital, Brisbane.

The appointment is announced of Dr. R. P. W. Francis (B.M.A.) as Honorary Assistant Surgeon to the Ear, Nose and Throat Department of the Hospital for Sick Children and of Dr. H. V. Foxton (B.M.A.) to the same office at the Mater Misericordiæ Hospital, Brisbane.

The Hospital Committee of the Melbourne Hospital have appointed Dr. Isabel A. Phillips (B.M.A.) and Dr. R. Howden (B.M.A.) Anæsthetists, Dr. H. F. Maudsley (B.M.A.) Medical Clinical Assistant and Dr. K. S. Cross (B.M.A.) Acting Radiologist to the Melbourne Hospital.

Dr. R. H. Minton Connell (B.M.A.), of Leonora, has been appointed a Justice of the Peace for the Mount Margaret Magisterial District of Western Australia.

Medical Appointments Vacant, etc.

For announcements of medical appointments vacant, assistants, locum tenentes sought, etc., see "Advertiser," page xxi.

University of Melbourne: Lecturer in Clinical Pathology.
Alfred Hospital, Prahran, Victoria: Honorary Pathologist.
Department of Public Health, New South Wales: Junior Assistant Microbiologist.
The Australian Hookworm Campaign: Medical Officer.

Medical Appointments.

IMPORTANT NOTICE.

Medical practitioners are requested not to apply for any appointment referred to in the following table, without having first communicated with the Honorary Secretary of the Branch named in the first column, or with the Medical Secretary of the British Medical Association, 429 Strand, London, W.C.

Branch.	APPOINTMENTS.
NEW SOUTH WALES. (Hon. Sec., 30.-34 Elizabeth Street, Sydney.)	Australian Natives' Association. Balmain United Friendly Societies' Dispensary. Friendly Society Lodges at Casino. Leichhardt and Petersham Dispensary. Manchester Unity Oddfellows' Medical Institute, Elizabeth Street, Sydney. Marrickville United Friendly Societies' Dispensary. North Sydney United Friendly Societies. People's Prudential Benefit Society. Phœnix Mutual Provident Society.
VICTORIA. (Hon. Sec., Medical Society Hall, East Melbourne.)	All Institutes or Medical Dispensaries. Manchester Unity Independent Order of Oddfellows. Ancient Order of Foresters. Hibernian Australian Catholic Benefit Society. Grand United Order of Free Gardeners. Sons of Temperance. Order of St. Andrew. Australian Prudential Association Proprietary, Limited. Mutual National Provident Club. National Provident Association.
QUEENSLAND. (Hon. Sec., B.M.A. Building, Adelaide Street, Brisbane.)	Australian Natives' Association. Brisbane United Friendly Society Institute. Stannary Hills Hospital.
SOUTH AUSTRALIA. (Hon. Sec., 3 North Terrace, Adelaide.)	Contract Practice Appointments at Renmark. Contract Practice Appointments in South Australia.
WESTERN AUSTRALIA. (Hon. Sec., 6 Bank of New South Wales Chambers, St. George's Terrace, Perth.	All Contract Practice Appointments in Western Australia.
NEW ZEALAND: WELLINGTON DIVISION. (Hon. Sec., Wellington.)	Friendly Society Lodges, Wellington, New Zealand.

Diary for the Month.

Sept. 28.—N.S.W. Branch, B.M.A., Medical Politics Committee; Organization and Science Committee.
Sept. 29.—Vict. Branch, B.M.A., Council.
Sept. 30.—S. Aust. Branch, B.M.A..
Sept. 30.—Vict. Branch, B.M.A., Election of two members to Federal Committee.
Oct. 1.—N.S.W. Branch, B.M.A., Annual Meeting of Delegates of Local Associations with the Council (first day).
Oct. 1.—Q. Branch, B.M.A..
Oct. 2.—N.S.W. Branch, B.M.A., Annual Meeting of Delegates of Local Associations with the Council (second day).
Oct. 5.—N.S.W. Branch, B.M.A., Council (Quarterly).
Oct. 6.—Vict. Branch, B.M.A..
Oct. 8.—N.S.W. Branch, B.M.A., Clinical.
Oct. 8.—S. Aust. Branch, B.M.A., Council.
Oct. 12.—Tas. Branch, B.M.A..
Oct. 12.—N.S.W. Branch, B.M.A., Ethics Committee.

EDITORIAL NOTICES.

Manuscripts forwarded to the office of this journal cannot under any circumstances be returned.

Original articles forwarded for publication are understood to be offered to *The Medical Journal of Australia* alone, unless the contrary be stated.

All communications should be addressed to "The Editor," *The Medical Journal of Australia*, B.M.A. Building, 30-34 Elizabeth Street, Sydney. (Telephone: City 2645.)